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VOL. 33. Ser. A. Part 6. pp. 161-192.

JUNE, 1945.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

**ISSUED BY THE IMPERIAL
INSTITUTE OF ENTOMOLOGY.**

**LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
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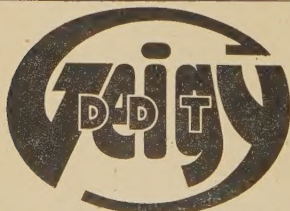
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LEVER (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **15** no. 1 pp. 14-19, 32 refs. Suva, 1944.

A crinkling and reddening of the leaves of lettuce observed in the Suva area of Fiji in September 1942 was found to be caused by *Thrips tabaci*, Lind., which had not previously been recorded from any of the islands of the southern Pacific. Dusting with derris gave satisfactory control, but it was not easy to reach the hearts with the dust. Nymphs were more abundant in the following January.

In July 1943, a tin of boot polish imported from New Zealand was found to be infested with larvae of *Megaselia scalaris*, Lw.; this Phorid had previously been reared from decomposed animal and plant remains in Fiji. The polish consisted mainly of wax, stearine and lamp black.

In December 1943, ripe growing fruits of jak [*Artocarpus integer*] and breadfruit [*A. communis*] were found to be infested with larvae of *Dacus* (*Chaetodacus*) *passiflorae*, Frogg., and *D. (Notodacus) xanthodes*, Broun, while ripe mangos growing near the breadfruit were not, though mangos are known to be host fruits. During January 1944, the egg, larval and pupal stages of *D. xanthodes* lasted 2-3, 5-6 and 11-12 days. It was reared on fruits of guava, granadilla [*Passiflora*] and breadfruit, and it oviposited but did not develop, in freshly cut fruits of papaya (*Carica papaya*). Larval parasites reared in January 1944 were *Opius* (*Biosteres*) *tryoni*, Cam., another Braconid and a Pteromalid of the genus *Spalangia*.

RISBEC (J.). **Observations sur les insectes des plantations en Nouvelle-Calédonie.**—128 pp., 161 figs., refs. Paris, Secrét. Etat Colon., Dir. Aff. écon., 1942. [Recd. 1945.]

This work deals with pests, mostly insects, that attack cotton, coconut, coffee, tobacco and fruit trees in New Caledonia. Descriptions and notes on the bionomics are given for most species, the injury caused by many is described, and brief recommendations are given for the control of some. The author states in a foreword that the book was written in 1932 and that the cultivation of cotton and tobacco on the island has since been discontinued. The sections dealing with pests of coconut (pp. 43-72) and coffee (pp. 73-88) have been noticed from other sources [*R.A.E.*, A **24** 746; **25** 223]. Insects that attack fruit trees, which are not grown on a commercial scale, include *Cryptorrhynchus mangiferae*, F., on mango, *Cosmopolites sordidus*, Germ., on banana, *Dacus* spp., which infest various fruits, notably peaches, and *Ceroplastes rubens*, Mask., which occurs on mango, *Citrus*, fig, and many other plants. *Aulacophora* (*Rhaphidopalpa*) *argyrogastrer*, Montr., is a polyphagous Galerucid that feeds chiefly on cucurbits, but of which the adults also attack graminaceous plants, notably wheat. A final section contains descriptions and notes on the bionomics of some insects that are predacious on insect pests.

Insect Pests.—*Agric. Gaz. N.S.W.* **55** pt. 3 pp. 111-114, 135, 6 figs. Sydney, 1944.

This part of a series on insect pests in New South Wales [*cf.* *R.A.E.*, A **32** 228] contains brief accounts of the habits of a number of common Lamellicorns, the injury they cause, and their control. Those that are injurious only in the larval stage are *Anodontonyx noxius*, Arr. (*tetricus*, auct.) on wheat and oats [*cf.* **16** 532; **20** 154], *Aphodius howitti*, Hope, in pastures [*cf.* **29** 547; **31** 265, etc.], and *Serices this pruinosus*, Dalm., which is common along the eastern coast and injures the roots of grasses in lawns and sometimes those of strawberries and vegetables. The larvae of *Heteronychus sanctae-helenae*, Blanch., attack grasses and sometimes maize seedlings, and the adults, which cause more damage, feed on maize, sugar-cane, vegetables and

other plants [cf. 28 46]. The adults of various species of *Anoplognathus*, which feed by day, often cause considerable injury to the foliage of *Eucalyptus* and the introduced pepper tree (*Schinus molle*) and also attack plum trees. The eggs are laid in the ground and the larvae develop chiefly in uncultivated land, but they sometimes occur in cultivated areas and damage the roots of strawberries and other garden plants.

MAY (A. W. S.) & CALDWELL (N. E. H.). **Fruit Fly Control.**—*Qd agric. J.* 58 pt. 4 pp. 224–229, 6 figs. Brisbane, 1944.

In Queensland, *Dacus* (*Strumeta*) *ferrugineus tryoni*, Frogg., is the principal fruit-fly on deciduous fruit-trees and *Citrus* and also seriously infests grapes, mangos, passion fruit [*Passiflora*] and papayas. *D. (Austrodacus) cucumis*, French, is the commonest species on cucurbits and is sometimes associated with damage to papayas, and *D. (Strumeta) musae*, Tryon, attacks bananas in the north [cf. *R.A.E.*, A 28 314].

The eggs of *D. f. tryoni* are laid in groups of as many as seven in punctures in the skin of the fruit and hatch in 2–3 days in warm weather. The larvae feed in the fruit, which usually drops, and pupate in the soil. The life-cycle lasts 2–3 weeks in summer, but is much longer in cool weather. No injury occurs during winter, though adults are frequently present in *Citrus* orchards. The control measures recommended comprise the use of glass fly-traps containing one of the baits recommended [cf. 32 167] and bait-sprays, orchard hygiene, and the treatment of breeding grounds outside the orchard, all of which are essential.

The traps should be hung within the trees away from the direct rays of the sun, with the bottom of the trap just above a few leaves on which the flies may alight. Distribution of the available traps in a limited number of selected trees results in excellent catches and simplifies recharging and inspection, and as many as six traps can be used in large trees. At least ten traps should be used to each acre of trees likely to require protection at any one time. In deciduous orchards, in which attacks may begin six weeks before the earliest fruit matures, single traps should be placed in each of 6–12 trees throughout the orchard in early October and inspected daily, and as soon as there is an obvious increase in the catch, full-scale trapping and spraying should begin. In *Citrus* orchards, although the fruit is not susceptible to injury until about three weeks before it matures, the same procedure is adopted, and the single traps are put in position at least six weeks before the earliest varieties are to be harvested. Full-scale trapping may be needed between late February and the end of April for early varieties and in early August for late ones. It may be unnecessary in May–July, in spite of the presence of mature fruit, because of the cooler weather.

Bait-sprays appear to give better results in the drier inland districts than in coastal ones. They should be applied every six days when the flies are active and more often if rain washes the deposits away. Applications should be made to the shady side of leafy trees, preferably early in the morning, with a spray pump or by splashing the liquid on to the leaves with a brush; 4 gals. spray will treat about 150 trees. A spray of 2½ oz. lead arsenate and 2 lb. sugar in 4 gals. water, or preferably water in which waste fruit has been boiled, is suggested, but sodium fluosilicate or tartar emetic may be used as the toxic agent. All waste and infested fruit should be collected every three days and burned where it is dumped within six days to destroy any pupae in the underlying soil, boiled immediately or covered with water until it can be boiled, buried under 18 ins. of soil, or emptied into pits fitted with insect-proof covers [cf. 30 370]. All likely breeding grounds near commercial fruit trees should be destroyed if they are of no value. If this is impossible, trapping and destroying infested fruit are often valuable in protecting neighbouring orchards.

JENKINS (C. F. H.). **Clothes Moths and Carpet Beetles.**—*J. Dep. Agric. W. Aust.* (2) **21** no. 1 pp. 51–57, 6 figs., 5 refs. Perth, W.A., 1944.

Notes are given on the appearance, bionomics and control of clothes moths and carpet beetles that are injurious in Western Australia. *Tineola biselliella*, Humm., and *Tinea pellionella*, L., are the only clothes moths present, but several carpet beetles occur, of which *Anthrenocerus australis*, Hope, one of the commonest, is typical. The eggs of this Dermestid are generally laid on wool, feathers, silk or fur and hatch in about a fortnight, and the larval period may occupy several months. The control measures suggested, most of which have already been noticed [*R.A.E.*, A **21** 288; **26** 400; **27** 188], include treatment with turpentine, which is an effective contact insecticide and leaves a residue that is repellent for some time, but may stain fabrics, and immersion of infested material for at least ten seconds in water at any temperature over 140°F., which kills all stages.

HAMILTON (A.). **The Clover Case-bearer. Insect injurious to White Clover Seed.**—*N. Z. J. Agric.* **63** no. 5 pp. 339–340, 5 figs. Wellington, N.Z., 1944.

Coleophora spissicornis, Haw., the adult and larva of which are briefly described, has in recent years attacked white clover [*Trifolium repens*] in a number of districts in New Zealand [*R.A.E.*, A **32** 78]. It occurs in grazed pastures, in fields of clover grown for seed, and on clover along the roadside, but is abundant only locally. The eggs are laid, one or two together, on the unfertilised flowers; one female deposited a total of about 90. The larvae hatch in 9–11 days and enter the developing pods to feed on the seeds; each later constructs a protective case of withered petals. They migrate from one inflorescence to another when the available food is becoming scarce and continue to feed throughout the late summer and autumn. They probably overwinter in their cases on the food-plant or on the ground and possibly feed again before pupating in the spring [cf. **26** 155]. Damaged flower heads are distinguished only by the presence of a few silken threads and small holes in the corolla tubes of individual flowers. The damaged seeds and most of the larval cases are separated from undamaged seed during the process of threshing.

OAKLEY (R. G.). **Preliminary Life-history Studies in Guam of the Scarab Beetle *Ancylonycha mindanaona* (Brenske).**—*J. Wash. Acad. Sci.* **35** no. 1 pp. 7–12, 2 figs., 4 refs. Menasha, Wis., 1945.

BÖVING (A. G.). **Description of the Larva and Pupa of the Scarab Beetle *Ancylonycha mindanaona* (Brenske).**—*T.c.* pp. 13–15, 8 figs.

The first paper contains an account of investigations in 1937–39 on the bionomics of *Lachnosterna* (*Ancylonycha*) *mindanaona*, Brenske, in Guam where it had been observed in damaging numbers on maize in 1935, having probably been introduced from the Philippines. In October 1937, ten fields of young maize in the most heavily infested area showed plant losses of from 35 to 95 per cent. with from 0.4 to 1.2 larvae per sq. ft., and in July 1939, nine of the 17 districts of the Island were known to be infested, three of them seriously. The larvae attack the lateral and tap roots of the food-plant and the adults feed on leaves at night. Lists are given of wild and cultivated plants observed to be attacked by the adults or larvae; the cultivated plants attacked by the adults were maize, coconut, avocado, banana, *Artocarpus* sp., cassava and kapok (*Ceiba pentandra*), and those attacked by the larvae were maize, coconut, beans (*Phaseolus*), *Citrus* and coffee. The egg, larval and pupal stages averaged 12.1, 301 and 17.4 days respectively, and development from egg to adult, including a prepupal stage lasting at least five days, averaged 335. Life-history studies showed that the larvae that hatch in March or April feed at depths of 4–6 ins. on decaying organic matter till the advent of rain in July, when they approach

the surface and attack living roots. They return to a greater depth in the drier weather of November–January and usually form an earthen pupal cell by January, unless food is still available, when they may continue feeding until March or later. The adults began to emerge from the soil in late February or March and were present till August, but oviposition ceased long before they disappeared. They returned to the soil before dawn, and the eggs were laid at depths of 4–6 ins., singly or in groups of 2–5. Dissections showed that the egg capacity was probably about 30. Many factors render it desirable to plant maize in September and October, but crops planted in these months are very liable to attack by the larvae.

Descriptions of the egg and adults (the latter by E. A. Chapin) are included in the first paper, and the three larval instars and pupa are described in the second.

KRISHNA AYYAR (P. N.) & MARGABANDHU (V.). **Biological Notes on *Sinoxylon sudanicum* Lesne and its Parasites in S. India.**—*J. Bombay nat. Hist. Soc.* 44 no. 3 pp. 460–465, 2 graphs, 4 refs. Bombay, 1944.

The results are given of observations on the Bostrychid, *Sinoxylon sudanicum*, Lesne, in southern India, where it is common in weakened or wilting green plants of cambodia cotton, particularly in October–January, and is an alternative host of the Braconid, *Spathius critolaus*, Nixon, an important parasite of the cotton stem weevil, *Pempherulus* (*Pempherus*) *affinis*, Faust [cf. *R.A.E.*, A 32 391]. The larvae and adults tunnel in the stems; cotton plants pulled up at the end of the season and stacked from April to August are heavily infested, and breeding is therefore continuous. There are four generations a year, of which the adults are present in September–October, December–January, April–May and July–August. In cages, females made egg chambers in cotton stems in about four days, the egg and larval stages together lasted about 30–32 days and the pupal stage 13–14. The adults usually entered the plants at the nodes and showed a strong preference for cambodia cotton, ignoring certain other malvaceous plants and also bamboos, though they bored in stalks of *Acacia* and mango to some extent.

Females of *S. critolaus* paralyse the mature or medium-sized larvae and deposit one or two eggs on each [cf. *loc. cit.*]. The parasite consumes the entire contents of the host and pupates in its tunnel. Other species of *Spathius*, particularly one near *labdacus*, Nixon, and three undetermined Chalcidoids were also observed to parasitise *Sinoxylon*, and the predacious mite, *Pediculoides ventricosus*, Newp., destroyed the immature stages of both host and parasites in the laboratory.

KRISHNAMURTI (B.) & APPANNA (M.). **Influence of Mercury on Insect Eggs.** Part I.—*Curr. Sci.* 14 no. 1 pp. 7–10, 2 figs., 6 refs. Bangalore, 1945.

An account is given of experiments in India on the use of mercury vapour for the control of pests of stored grain and pulses [cf. *R.A.E.*, A 32 418, etc.], notably *Corcyra cephalonica*, Staint., and *Bruchus chinensis*, L. Eggs of the former less than 24 hours old, and of the latter less than 48 hours old, failed to hatch after being enclosed under a crucible containing mercury in sealed jars, but it had no effect on older eggs of either species, or on the larvae, pupae or adults. The period of exposure necessary to kill the eggs was greater than 24 and less than 48 hours and the minimum lethal dose of mercury was 0.03 gm. for a jar of 3,300 cc. capacity and 0.05 gm. for one of 4,000 cc. By applying an impervious coating to different areas of the eggs, it was shown that mercury vapour enters the eggs through the micropyle. The mercury was equally effective in empty jars when placed at heights of about 1, 3 and 6 ins. above the eggs, but when 0.03 gm. (the minimum lethal dose) was placed in a crucible on grain in a jar of 3,300 cc. capacity, eggs of *Corcyra* placed at a depth of about an

inch were killed, but not those at about 4 or 5 inches. Mercury vapour was also found effective in the preliminary tests against eggs (less than 16 hours old) of *Calandra oryzae*, L., *Tribolium confusum*, Duv., and *Rhizopertha dominica*, F.

GOLDING (F. D.). **Palm Kernel Borer.**—*S. P. circ. Memor.* no. 34, 2 pp. multigraph. [Ibadan, Agric. Dep. Nigeria] 1944.

In March 1944, stored nuts of the oil palm [*Elaeis guineënsis*] from Benin, Nigeria, were found to be infested by a Bruchid, identified as *Pachymerus lacerdae*, Chev., a native of Brazil, which is thought, from the results of a survey and other information, to have been present in the eastern Provinces for at least 20 years. The eggs are unknown but are almost certainly laid in the micropyles of fallen nuts and old nuts on the trees, though those still covered with pulp are not attacked. The larvae burrow into the kernels and pupate there, and the adults bore out through the shells, leaving circular holes; they appear to find greater difficulty in leaving nuts on the palm than those on the ground. The adults are attracted to light. *P. lacerdae* was found to occur in the field at Benin, Itsekiri (Warri), Onitsha and several localities in the Owerri and Calabar Provinces, and examination of fallen nuts and old nuts on the trees in four localities showed that 11–46 per cent. were infested. Recommended control measures comprise regular harvesting and collection of fallen nuts, ring-seeding round the bases of the palms if necessary to facilitate collection; keeping the trees free from ferns and dead fronds; collecting nuts held in leaf axils and refuse on the palms; cracking the nuts as soon as possible after drying; and fumigating stored nuts.

RISBEC (J.). **Sur la présence en A.O.F. de deux nouvelles espèces d'insectes très nuisibles et non encore signalées.**—*Notes afr.* no. 22 p. 14. Dakar, 1944.

The pink cotton bollworm, *Platyedra* (*Pectinophora*) *gossypiella*, Saund., and the potato beetle, *Leptinotarsa* (*Chrysomela*) *decemlineata*, Say, are recorded for the first time from French West Africa, where the former was found in Upper Senegal and the latter on tomato in the Ivory Coast. Very brief notes are given on their appearance and habits, together with the distribution of *P. gossypiella* in neighbouring parts of Africa and in other French Colonies, including New Caledonia, New Hebrides and Algeria, and a summary of the spread of *L. decemlineata* in North America and Europe.

ALFARO (A.). **La invasión del escarabajo de la patata al finalizar la campaña de 1941.** [The Invasion of the Potato Beetle at the End of the Campaign of 1941.]—*Bol. Pat. veg. Ent. agric.* 11 pp. 119–124, 1 col. pl., 1 map. Madrid [?1943].

The author reviews the spread of the potato beetle [*Leptinotarsa decemlineata*, Say] in Spain since it was first observed there, in the extreme north-east, in 1935 and 1936. Its spread was favoured by the disorganisation accompanying the Civil War, and subsequent world conditions led to a great shortage of arsenicals for its control. Owing to the measures taken, however, it has not caused any great reduction in potato crops. It was present in 13 provinces in the north and north-east of Spain in 1940 [cf. *R.A.E.*, A 30 393] and spread further to the south and west in 1941, when summer conditions were very favourable for its development, so that 19 provinces were affected by the end of the season. The previous distribution of the beetle and the foci of infestation recorded in that year are shown on a map, and the latter are briefly discussed.

ALFARO (A.). **El desarrollo del escarabajo de la patata sobre algunas variedades de tomate.** [The Development of the Potato Beetle on some Varieties of Tomato.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 125–130, 1 fldg. table, 1 ref. Madrid [?1943].

As tomatos growing in areas in which *Leptinotarsa decemlineata*, Say, occurs are sometimes attacked by it and sometimes free from infestation, experiments were carried out in Spain in 1941 and 1942 to ascertain whether this was due to varietal preference [cf. *R.A.E.*, A **25** 51]. Newly hatched larvae in batches of ten were caged with leaves of 18 varieties of tomato. The leaves were renewed daily, and when the larvae reached the fourth instar, they were transferred to cages containing a layer of soil. Records were made daily, and the results are shown in tables. The duration of development on the leaves and of total development in the cages averaged 17–24 and 29–39 days, respectively, and the number of adults obtained per cage was 1–9. There was considerable variation in the amount of leaf consumed for the several varieties, and the larvae fed least on and showed a tendency to migrate from the five on which development was slowest and mortality greatest. The adults that were obtained in 1942 fed readily on the leaves of all the seven varieties tested in that year, but when pairs of adults were fed for at least a month on potato leaves before being offered tomato, they rejected three varieties almost entirely, though they fed readily on three others. When transferred from a preferred to a distasteful variety, or from a distasteful to a preferred one, their reaction remained the same as on the variety on which they were first placed. In all cases, however, mortality was greater than on potato. It is concluded, therefore, that no variety is immune from attack though some may be infested less severely than others.

GÓMEZ-MENOR (J.). **Nueva especie de *Stictococcus* de la Guinea española, parásito del cafeto.** [A new Species of *Stictococcus* in Spanish Guinea attacking Coffee.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 131–141, 4 figs., 16 refs. Madrid [?1943].

The author describes the adult female and the young of both sexes dissected from the parent female of *Stictococcus guineensis*, sp. n., which infests the twigs of coffee in Spanish Guinea, gives characters distinguishing it from two closely related species, discusses the systematic position of the genus *Stictococcus*, and gives a list of species, all of which occur in tropical Africa, showing their food-plants and distribution.

DOMÍNGUEZ GARCÍA-TEJERO (F.). **Los *Cleonus* de la remolacha.** [*Cleonus* spp. attacking Beet.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 142–154, 6 figs., 13 refs. Madrid [?1943].

Sugar-beet is attacked in Spain by *Cleonus* (*Conorrhynchus*) *mendicus*, Gylh., *C. (Bothynoderes) punctiventris*, Germ., *Lixus junci*, Boh., *L. elegantulus*, Boh., and an undetermined species of *Lixus*. Of these weevils, *C. mendicus* is the commonest and *C. punctiventris*, which causes little injury, the least numerous; the distribution of all of them is shown on a map. The egg, larva and adult of *C. mendicus* are described, and an account of its bionomics and control is given, based on the work of Picard in France [*R.A.E.*, A **2** 89, 451] and of Menozzi in Italy [27 301; 29 316, etc.]. *C. punctiventris*, which prefers sandy soil, is of greater importance in Russia [30 64].

MORENO MÁRQUEZ (V.). **Dos formas de langosta común o marroquí (*Dociostaurus maroccanus* Thunb.), reveladas biométricamente.** [Two Forms of the Moroccan Locust studied biometrically.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 155–178, 16 figs., 1 ref. Madrid [?1943].

Detailed biometrical studies, the results of which are analysed statistically, were carried out on three lots of adults of *Dociostaurus maroccanus*, Thunb.,

each comprising 25 males and 25 females taken at random in 1940 from a swarm, and in 1941 and 1942 from scattered populations, in the region of La Serena, Spain. Biometrically, the first form (1940) differed significantly from the form of 1941 and 1942 by a larger absolute size, a similarity in size between the two sexes, and higher values for the ratios elytron : femur and wing : femur. Since the two forms are considered to be closely related, they may be regarded as biological modifications (phases).

DEL CAÑIZO GOMEZ (J.). **La langosta y el clima.** [Locusts and Climate.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 179–200, 8 figs., 1 fldg. map, 19 refs. Madrid, [? 1943].

The principal outbreak areas of *Doclostaurus maroccanus*, Thnb., in Spain are situated in arid regions [R.A.E., A **26** 698], where the annual rainfall averages about 16–22 ins., and the average annual relative humidity is below or slightly above 60 per cent. When monthly rainfall data were studied for known outbreak areas near Madrid and in Badajoz and Ciudad Real, no correlation was found between the total annual rainfall and the incidence of outbreaks. Since field observations have shown that approximately 0.6–0.8 in. of rain is required to cause the eggs to hatch, it was decided to study the rainfall during the critical period for egg development in spring (February–April or March–May, according to the zone), and to subtract 0.8 in. from the monthly rainfall figures for that period. The resulting rainfall for the spring period is called the sum of effective rainfall. When graphs of the effective rainfall for the period 1914–26 in Badajoz were compared with the indices of the severity of outbreaks, it was found that the outbreak of 1921–23 was preceded by five springs (1917–21) in which the effective rainfall was below the average, particularly in 1921, while in the next three years the rainfall increased and the outbreak decreased. Similar results were obtained from examining graphs of effective rainfall for Madrid for the periods 1897–1903 (outbreak in 1900–03), 1907–17 (outbreak in 1909–11) and 1918–28 (outbreak in 1921–24). It is concluded that 3–5 years with deficient effective spring rainfall are required to produce an outbreak. The collapse of outbreaks after 2–3 years appeared to depend on abundant winter rainfall and favourable temperatures, which shorten the normal duration of diapause and hasten hatching, with a consequent rise in mortality of nymphs appearing out of season [**20** 548]. The establishment of meteorological stations in the main outbreak areas is urged.

RUIZ CASTRO (A.). **Insectos xilófagos : cuatro coleópteros de la madera labrada.** [Xylophagous Insects : four Coleoptera that attack worked Wood.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 201–239, 14 figs., 45 refs. Madrid [? 1943].

Structural timbers and wooden furniture in Spain are attacked by the Cerambycids, *Stromatium fulvum*, Villers (*unicolor*, Ol.), *Hylotrupes bajulus*, L., and *Hesperophanes cinereus*, Villers, and by *Anobium punctatum*, Deg. The author reviews the synonymy, distribution (with particular reference to Spain), and morphology of various stages of these beetles, gives a key to the larvae, also distinguishing them from those of *Xestobium rufovillosum*, Deg., and Buprestids, and discusses the life-history and diverse feeding habits of various groups of Longicorns. He then gives notes, based largely on the literature, on the bionomics of the four beetles first mentioned, and a review of the measures employed for their control in various countries. All of them attack trees of various kinds as well as worked wood, though *Hylotrupes* and *Anobium* are restricted to dead or dying wood. *Hylotrupes* is furthermore almost entirely

confined to coniferous softwoods, while the others are most injurious to hardwoods, though *Stromatium* has also been recorded as attacking softwoods. In houses, *Hylotrupes* therefore occurs chiefly in structural timbers, while the others mostly bore in furniture. The three Cerambycids develop slowly, the life-cycle in Spain usually lasting three or four years for *Stromatium* and *Hylotrupes* and two or three for *Hesperophanes*. *Anobium* develops in a year in temperate climates, requires two years in cold ones or in very dry wood, and produces two generations a year in hot climates.

GÓMEZ-CLEMENTE (F.). **La plaga de *Sphaeroderma rubidum* (Graëlls) en los alcachofales de Valencia.** [*S. rubidum*, a Pest of Artichokes in Valencia.] —*Bol. Pat. veg. Ent. agríc.* 11 pp. 259–282, 13 figs., 9 refs. Madrid [? 1943].

Since 1935, artichokes (*Cynara scolymus*) in the region of Valencia have been severely injured by the Halticid, *Sphaeroderma rubidum*, Graëlls, and their cultivation has had to be abandoned in some cases. The nomenclature of the species of *Sphaeroderma* is briefly discussed, all stages of *S. rubidum* are described, its original description is quoted, and its distribution is reviewed. It has one generation a year. In 1941, the adults emerged in mid-April and became numerous towards the end of May. They fed on the leaves, but without perforating them, and the injury at this season was slight. From the end of June until early September, while active growth of the plants is suspended, the beetles aestivated beneath plant debris or stones. They resumed activity after rains had stimulated vegetation, and again fed on the leaves, but sometimes perforated them. Pairing occurred at this time and oviposition began in a few days, the eggs being laid singly in small cavities in the young leaves, usually close to the secondary veins, where they were concealed by the hairs that cover the leaf. Three females kept with males at 17°–23°C. [62°–73°–4°F.] oviposited 3, 4 and 2 days after pairing, depositing 17, 52 and 36 eggs in 3, 35 and 17 days, respectively. Four lots of eggs hatched in 13–14, 17–18, 15–18 and 18–25 days. The larvae mined in the leaves towards the edges and were full-fed in November. They then crawled down the main stem and overwintered in the soil close to the plants at a depth of about an inch. Pupation occurred in early March, and the pupal stage lasted about a month. Injury by the larvae is severe, and up to 20 have been observed in a single leaf. The combined attack by larvae and adults in autumn, when the plants are producing the first crop of heads, kills many of the plants and causes great reductions in both crops. Figures based on information from growers are given showing that percentage losses of 50 and 30 in the two crops, respectively, are caused by moderate infestations, and 100 and 50 by severe ones.

Control is difficult, since the eggs and larvae are protected by the plant and the pupae by the soil. In experiments in 1940, the plants were injured when fumigated with hydrocyanic acid gas under small tents, and the larvae in their mines were not killed. Investigations were therefore carried out in the laboratory on the use of insecticides against the adults. All beetles were killed in 72 hours by a spray containing 1½ lb. calcium arsenate (40 per cent. arsenic pentoxide) per 100 gals. water, and 86 per cent by one containing 2 lb. lead arsenate (30 per cent. arsenic pentoxide), but arsenicals should not be applied when the edible heads are present. In further experiments, complete mortality was given in 24 hours by a spray of 5 per cent. pyrethrum extract and 10 per cent. potash soap and by dusts of 1 part pyrethrum powder and 1–4 parts sulphur or 1 part ash. Sprays of oil emulsions or nicotine and soap were less effective, though the latter gave complete mortality in some tests. It is recommended that a contact spray or dust should be applied when the adults emerge in spring or when they leave their aestivation quarters in autumn. In the latter case, a second application should be made 8–10 days later, and a third if necessary, while all leaves showing signs of attack by larvae should be destroyed.

BELLOD (M.). **Estudio económico de los tratamientos de invierno contra la oruga del almendro** (*Aglaope infausta* L.). [An economic Study of Winter Treatments against the Almond Worm (*A. infausta*).]—*Bol. Pat. veg. Ent. agric.* **11** pp. 283–294, 9 figs., 2 refs. Madrid [?1943].

The costs of treatments effective for the control of larvae of *Aglaope infausta*, L., hibernating on the trunks and branches of almond [cf. *R.A.E.*, A **30** 477] were investigated in experiments near Valencia in February 1942. All the mixtures tested were made up to 10 gals. with water. It was found that, as compared with scraping and brushing with a mixture of 8 lb. ferrous sulphate and 8 lb. quick-lime, brushing the unscraped trunks and branches with one of 30 lb. quick lime and 1 gal. tar oil [*loc. cit.*] reduced the cost of treatment by 58 per cent., and applying one of 20 lb. quick-lime and 1 gal. tar oil to the unscraped trees by means of a pressure sprayer, except for the top branches, which were brushed to avoid injury to the buds, reduced it by 28 per cent., while scraping the trees and treating them in the same way with the ferrous-sulphate mixture increased it by 18·4 per cent.

In further experiments, the effect was tested of applying bands of corrugated paper to the trunks and branches to trap larvae seeking hibernation quarters. The bands were applied in mid-July to trees 10–12 years old with fairly smooth bark, which was left unscraped, and were 5–6 cm. wide and 4–5 mm. thick, with corrugations 7 mm. apart. They were examined on 7th August, when all the larvae had left the leaves, and it was found that many had congregated under them. Two bands 36 and 35 cm. long placed on trunks contained 3,315 and 2,042 larvae, respectively, and even greater numbers occurred on the bark beneath them. Some of the larvae were still moving, and it is suggested that the bands should not be removed and destroyed until the end of autumn, when all will be in hibernation. It is considered that the use of trap-bands would be a useful supplement to winter treatment, and might well replace it on young trees.

HERCE (P.). **Análisis químico de los polisulfuros.** [The chemical Analysis of Polysulphides.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 295–330, 3 refs. Madrid [?1943].

Lime-sulphur is used in various parts of the world for the control of Coccids. The mode of action of the polysulphides is not exactly known, but the author considers that their effect is due to their reducing properties, which inactivate the oxidising enzymes, thus disturbing the respiratory metabolism. Furthermore, the polysulphides exercise a repellent effect and dissolve chitin. Liquid lime-sulphur, in which the pentasulphide and tetrasulphide predominate, is more effective than dry lime-sulphur, in which the trisulphide, thiosulphate and free sulphur are predominant.

The chemical nature of the polysulphides and their analysis are discussed at some length, and the author proposes a modification of Bodnár's method for analysing lime-sulphur. He considers the Wöber-Sander method acceptable for rapid analysis. These methods are described in detail.

PLANES (S.). **Consideraciones sobre la tensión superficial de los líquidos insecticidas y antieriptogámicos.** [Considerations on the Surface Tension of insecticidal and fungicidal Liquids.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 338–345, 5 figs. Madrid [?1943].

In view of the present shortage in Spain of soaps for use as wetters in sprays, investigations were carried out on the reduction in surface tension of water caused by sodium sulphuricinate. It was found to be considerable and greater in hard (alkaline) waters than in distilled water. A concentration of 0·5 per cent. sulphuricinate was sufficient to enable Bordeaux mixture to wet cabbage

leaves thoroughly. If it was left in solution in hard waters, the surface tension gradually increased again, owing to the precipitation of calcium salts, so that it is best added to spray liquids immediately before use. It was less effective, however, in reducing surface tension than sodium or potassium oleate. The effect of the oleates was greater in distilled than in hard water, and there was no alteration in surface tension on standing for 48 hours. Concentrations of 0.5 per cent. in hard water and 0.125 per cent. in rain water were sufficient for wetting of cabbage leaves.

BENITEZ MORERA (A.). **Algunos datos biológicos sobre la *Taragama (Megasoma) repanda* Hübner.** [Some biological Data on *T. repanda*.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 346–349, 3 figs., 1 ref. Madrid [1943].

The author states that the Lasiocampid, *Taragama repanda*, Hb., the larvae of which have been recorded as injurious to the leaves of orange [*R.A.E.*, A **30** 482], breeds on *Retama monosperma* in the district of Cadiz. The larvae occur in groups of 8–10 on the leaves and in experiments refused to feed on those of other plants, the names of which are not given. There are apparently two generations a year, since larvae were observed in January–April and August–October, and pupae and adults in April–May and August–September. A few of the larvae were parasitised by undetermined Tachinids.

BENITEZ MORERA (A.). **Notas sobre la biología y parásitos de *Ocnogyna boetica* (Rambur) var. *meridionalis* (Seitz).** [Notes on the Biology and Parasites of *O. boetica* var. *meridionalis*.]—*Bol. Pat. veg. Ent. agric.* **11** pp. 383–386, 4 figs., 3 refs. Madrid [1943].

Ocnogyna boetica var. *meridionalis*, Seitz, is very abundant and is a fairly serious pest in certain parts of Spain, so that control measures have to be applied against it. The most important parasite of the larvae is an undetermined Tachinid, and in 1942 the author bred the Ichneumonid, *Erigorgus melanobatus*, Grav., from the pupae. In Morocco, where this Arctiid is also sometimes injurious to various crops [*cf. R.A.E.*, A **11** 356], it is parasitised by the Braconid *Apanteles spurius*, Wesm., and *Carabus rugosus*, F., has been recorded as predacious on the larvae. *C. rugosus* var. *boeticus*, Deyr., occurs near Cadiz, but is not sufficiently numerous to afford much control.

In an experiment, two females of *Ocnogyna* exposed at 11 a.m. on a dull day in an area of low vegetation attracted over 30 males in a quarter of an hour. When the test was repeated on a sunny evening, however, only a few males were attracted.

BARNES (H. F.). **Gall Midge Larvae among stored Seeds.**—*J. R. hort. Soc.* **69** pt. 8 pp. 242–243, 1 pl. London, 1944.

The author states that the Cecidomyiid larvae sometimes found among the stored seeds of plants are not usually injurious. Although certain Cecidomyiids prevent the formation of seed or destroy it when it is formed, some of these, such as *Contarinia merceri*, Barnes, leave the seed heads before harvesting or threshing, and others, such as *Dasyneura alopecuri*, Reut., and *Stenodiplosis geniculati*, Reut., which remain with the seed, have ceased feeding by the time the seed is ripe; also the larvae of injurious gall midges usually remain in the seed cases. The free-living larvae found among seeds are either inquilines, usually of the genus *Clinodiplosis*, which do not damage the seed, or species of *Lestodiplosis* or associated genera, which are predacious on other Cecidomyiids or on mites; examples are given of their occurrence among stored seeds of various plants.

WILSON (G. F.). **The Yew Scale.**—*J. R. hort. Soc.* **69** pt. 8 pp. 244–248, 2 pls., 1 fig., 5 refs. London, 1944.

The Coccid, *Eulecanium (Lecanium) corni crudum*, Green, feeds on yew (*Taxus*) in England [cf. *R.A.E.*, A **22** 362] and produces honey-dew on which sooty moulds grow so that the normal functions of the lower leaves are impeded by the thick mat that forms on the upper surfaces. The female scales cluster on the small branches and, to some extent, on the lower surfaces of the leaves, and male pupae are numerous on the leaves. Oviposition begins at the middle or end of June and hatching has been observed in southern England as early as 21st June. In late July and August, the young leave the shelter of the parent scale and move over leaves and shoots for a time before settling to feed. They usually overwinter in the second instar and sometimes become active again for a short period in spring. Both females and winged males mature in the middle of May or early June, but reproduction is considered to be chiefly parthenogenetic. The scale is dispersed by the movement of infested plants and possibly by birds and insects. A map showing its known distribution in southern England is given.

The most effective method of control is thorough spraying of foliage and shoots, particularly on the underside, with an emulsion of 3 fl. oz. nicotine, 3 pints summer white oil and 40 gals. water, between mid-August and mid-September or in March or both. Other contact sprays may be used against the newly hatched crawlers, but are less effective. Nicotine dust applied in autumn at temperatures above 65°F. gives good control on nursery stock, but is not recommended for hedges and garden trees, as the dust persists on leaves covered with honeydew and disfigures the plants.

Other widely distributed pests of yew are the Cecidomyiid, *Taxomyia taxi*, Inchbald, which produces galls of numerous leaves massed together, usually at the ends of the shoots, the Tortricid, *Batodes (Ditula) angustiorana*, Haw., which partly girdles the shoots, causing them to turn brown and die, and the weevil, *Otiorrhynchus sulcatus*, F., which feeds on the leaf margins.

CHAMBERS (V. H.) & HEY (G. L.). **An Experiment with D.D.T. for the Control of Apple Blossom Weevil.**—*Fruit* **5** no. 9 pp. 218–220. Chelmsford, Essex, 1944.

An account is given of tests with DDT [2, 2-bis (parachlorophenyl)-1, 1, 1-trichlorethane] for the control of the apple blossom weevil [*Anthonomus pomorum*, L.] carried out in 1944 in part of a heavily infested apple orchard adjoining a wood in Essex. A spray containing a proprietary form of DDT known as De-di-tox and 2½ lb. lead arsenate, 3 gals. lime-sulphur and 8 oz. wetting agent per 100 gals. was applied at a pressure of 350–400 lb. per sq. in. to about 60 Cox's orange pippin and Worcester pearmain trees at the rate of about 2 gals. per tree on 5th April when the buds were breaking, and although heavy rain (0.15 in.) fell before the deposit was dry, numerous dead weevils were found within 48 hours on sacks put under one of the trees. On 11th April, when there was still a good deposit, and no weevils were found on treated trees though they were numerous on untreated ones, a spray containing DDT and the wetting agent only was applied to the former. No dead weevils were found on the sacks after this spraying. On 17th April, when no weevils were found on treated trees, but about 30 were beaten from an adjacent untreated one, a third application similar to the first was made to all but 32 of the trees that had already been sprayed with DDT and to about 30 that had not. The other trees in the orchard, including those selected as controls, were sprayed with lead arsenate and lime-sulphur on about the same dates as the first and third applications of DDT, and the whole orchard received the usual pink-bud and petal-fall applications. When the trees were in full bloom there was abundant

blossom on treated trees and very little on untreated ones. Examination of random samples of 600-800 blossoms taken all round each tree on 12th and 15th May, when the petals were falling, showed that the percentages of infested blossoms on Cox's orange averaged 60·3 on untreated trees and 17·2 and 18·2 on those receiving two and three applications of DDT, respectively, while corresponding figures for Worcester pearmain were 33·4, 2·6 and 2·8. Trees receiving only one application were heavily infested.

In a second experiment in which trees in another orchard were sprayed with DDT on 5th and 11th April, the percentages of blossom infested averaged 8·6 for treated trees and 13·4 for untreated ones.

WATERSTON (J. M.). *Citrus Culture in Bermuda*.—*Bull. Dep. Agric. Bermuda* no. 22, 21 pp., 1 pl., 1 fig. Hamilton, Bermuda, 1944.

One section of this bulletin (pp. 14-16) deals with pests of *Citrus* in Bermuda, of which the most important is *Lepidosaphes beckii*, Newm., though *Dialeurodes citrifolii*, Morg., and *Aleurodicus* (*Metaleurodicus*) *cardini*, Back, are very injurious [cf. *R.A.E.*, A 30 557]. Fiddlewood trees [*Citharexylum spinosum*] are favoured food-plants of the Aleurodids and should be eradicated. All three insects can be controlled by thorough applications of oil emulsion (1·25 per cent. actual oil). Crawlers of *L. beckii* emerge chiefly in late March and early April, late June and early July and late September and early October. The spray against this Coccid should be applied to grapefruit between 15th May and 1st August and to oranges between 15th June and 1st August; a second spray may be required between 20th September and 15th October. Oranges are liable to injury by an oil spray applied in late May or early June. The first pest that is likely to appear on newly planted trees is *Aphis gossypii*, Glov., which causes distortion of young leaves and water shoots on trees of all ages, but is usually effectively controlled by the parasite *Aphidius* (*Lysiphlebus*) *testaceipes*, Cress.; if necessary a spray of 1 pint nicotine sulphate in 100 gals. soapy water should be applied.

The mature fruits of orange and grapefruit are disfigured by *Phyllocoptruta* (*Eriophyes*) *oleivorus*, Ashm., in winter: *Tetranychus sexmaculatus*, Ril., which is most common on grapefruit, occurs on the lower surface of the leaves and causes spotting and defoliation: and *Paratetranychus citri*, McG., which is commonest on orange and tangerine, causes discoloration of twigs, foliage and fruit, sometimes accompanied by defoliation when heavy infestations are present in dry weather. The first two mites can be controlled by a spray of 5-10 lb. wettable sulphur in 100 gals. water, and the last by the same spray with the addition of 11 oz. DN (dinitro-o-cyclohexylphenol), or by a spray of $\frac{3}{4}$ -1 per cent. oil.

Ceratitis capitata, Wied., rarely causes serious damage to *Citrus* in Bermuda, but is occasionally found on sweet orange or grapefruit. A list is given of the other fruits it infests [cf. 30 557, 558], and orchard sanitation, the elimination of wild food-plants and the use of bait-traps and bait-sprays [cf. 30 557] are recommended for its control.

FRAZIER (N. W.). **Phylogenetic Relationship of the nine known Leaf-hopper Vectors of Pierce's Disease of Grape.** (Abstract.)—*Phytopathology* 34 no. 12 pp. 1000-1001. Lancaster, Pa., 1944.

The Jassids that have been shown to transmit the virus of Pierce's disease of grape vines [cf. *R.A.E.*, A 30 227; 31 364] comprise *Draeculacephala minerva*, Ball, *Carneiocephala fulgida*, Nott., *C. triguttata*, Nott., *Neokolla circellata*, Baker, *N. gothica*, Sign., *N. confluens*, Uhl., *N. hieroglyphica*, Say, *Helochara delta*, Oman, and *Cuerna occidentalis*, Oman & Beamer. Of the

numerous Jassids that have so far been tested as vectors of this disease, every species of the subfamily AMBLYCEPHALINAE and no species of any other family have been found to transmit it.

HEUBERGER (J. W.) & WOLFENBARGER (D. O.). **Preliminary Report on DDT in the Potato Fungicide Program.** (Abstract.)—*Phytopathology* **34** no. 12 p. 1003. Lancaster, Pa., 1944.

In an experiment on late-planted potatoes, DDT [2, 2-bis (parachlorophenyl)-1, 1, 1-trichlorethane] at a concentration of 12 oz. per 100 U.S. gals. was used alone and in combination with two fungicides, Compound A (copper oxychloride) and zinc dimethyl dithiocarbamate, in programmes involving five applications. The numbers of *Empoasca fabae*, Harr., on 8th September averaged approximately 7.6 per 20-foot row for those treated with the fungicides alone or left untreated and 1 for DDT alone or combined with either of the fungicides. No foliage injury was observed where DDT was used; the plants treated with it were larger and darker green in colour, and the leaflets were larger and less cupped. It had no effect on early blight (*Alternaria solani*) or on control of the latter by the fungicides.

LEACH (J. G.) & BISHOP (C. F.). **Further Studies on the Nature and Cause of Purple-top Wilt of Potatoes.** (Abstract.)—*Phytopathology* **34** no. 12 pp. 1006–1007. Lancaster, Pa., 1944.

It is concluded from a five-year study in West Virginia that purple-top wilt (blue stem) of potatoes is caused by the aster-yellows virus [*Chlorogenus callistephi* var. *vulgaris* of Holmes] and is transmitted to potatoes chiefly by infected aster leafhoppers [*Macrostelus divinus*, Uhl.] that have survived the winter as adults [cf. *R.A.E.*, A **31** 275]. The incubation period is longer in potatoes than in asters. In West Virginia, infection must take place not later than July to produce symptoms on late potatoes maturing in early September. Early varieties usually mature before completion of the incubation period, whereas they are severely affected further north. This can probably be explained by differences in mass movements of leaf-hoppers in different regions. All attempts to transmit the virus from potatoes to asters or potatoes, by grafting or by leafhoppers, have failed.

ZENTMYER (G. A.) & WALLACE (P. P.). **Factors influencing the Development of *Ceratostomella ulmi* in Elm Trees.** (Abstract.)—*Phytopathology* **34** no. 12 p. 1014. Lancaster, Pa., 1944.

One of several factors found to influence the initiation and development of Dutch elm disease (caused by *Ceratostomella ulmi*) in elm in the United States was the age of the wood in which the fungus was growing. Elms that had been defoliated in June by *Alsophila pometaria*, Harr., and *Palaeocrita vernata*, Peck, were much more severely affected than others when artificially infected with the fungus, possibly because the formation of spring wood was prolonged.

ZENTMYER (G. A.), WALLACE (P. P.) & HORSFALL (J. G.). **Distance as a Dosage Factor in the Spread of Dutch Elm Disease.**—*Phytopathology* **34** no. 12 pp. 1025–1033, 2 figs., 10 refs. Lancaster, Pa., 1944.

To obtain information on the extent to which the spread by *Scolytus multi-striatus*, Marsh., of *Ceratostomella ulmi*, the fungus that causes Dutch elm disease, is likely to decrease with distance from the source of infection [cf. *R.A.E.*, A **32** 47, etc.], single isolated, naturally infected trees were selected in Connecticut in the summer of 1941 as centres for three plots. Adult beetles were then emerging and some had probably emerged in 1940; by the spring of

1942 all three trees had died of the disease. In August and September 1942, observations were made on subsequent infection resulting from the spread of the fungus on these plots. All elms within $\frac{1}{4}$ mile of each of three diseased trees were examined for symptoms and all elms within 320 ft. were mapped and examined for new infections. Of 195 elms within 320 ft. of the originally infected ones, 28 became infected. The greatest distance of spread was 180 ft., 75 per cent. of the new infections were within 100 ft., and 40 per cent. of the trees within 75 ft. became diseased. Analysis showed that the probability that a tree would become infected decreased directly with the logarithm of the distance from the source of infection. Intensification of the disease was very marked in the immediate vicinity of the original infected elms. Prevailing south winds during beetle emergence apparently caused a divergence in the distance of dissemination of the fungus, which was about twice as great to the north of the plots as to the south.

JONES (L. K.). **Mosaic, Streak and Yellows of Carnation.**—*Phytopathology* **35** no. 1 pp. 37–46, 1 fig., 10 refs. Lancaster, Pa., 1945.

An account is given of experiments in Washington State showing that the disease of carnations known as yellows, which is commoner in the central and western United States than in the north-eastern part and has been very injurious to carnations in Washington, is due to a combination of two viruses, mosaic and streak. Their symptoms are described. Mosaic is by itself of little economic importance and streak alone appears to produce no symptoms on the flower, though many of the lower leaves turn yellow and die. The virus mosaic was readily transmitted by mechanical inoculation but was not transmitted by *Myzus persicae*, Sulz., or *Thrips tabaci*, Lind., while streak was transmitted by *M. persicae*, but not by mechanical means or by *T. tabaci*. Neither virus was transmitted through the seed. Control of the Aphids is the best method of reducing loss due to yellows.

BRIERLEY (P.) & SMITH (F. F.). **Additional Species of *Lilium* susceptible to Lily-rosette Virus.**—*Phytopathology* **35** no. 2 pp. 129–131, 1 fig., 5 refs. Lancaster, Pa., 1945.

An account is given of investigations on the host range of the disease of Easter lily (*Lilium longiflorum*) known as lily rosette or yellow flat, the occurrence of which in the United States has been confirmed so far only for Florida. The tests were made with *Aphis gossypii*, Glov., the only known vector of the virus [cf. R.A.E., A **17** 615], which was allowed to feed on naturally infected plants or experimentally infected seedlings of *L. longiflorum* and then transferred to healthy seedlings of 13 species or varieties of *Lilium*. Some symptoms of the disease were observed in some of the seedlings of all the species or varieties tested, though no other species showed such well defined symptoms as the Easter lily. Lily rosette is thus of considerable potential importance in the case of several garden lilies. Many of these, although worthless for ornament when affected, do not show sufficiently clear symptoms to permit accurate diagnosis and could serve as unsuspected reservoirs of the virus.

HENDERSON (W. W.). **Four devastating Melanopli found in Utah (Orthoptera-Cyrtacanthacrinae).**—*Great Basin Naturalist* **5** no. 1–2 pp. 1–22, 4 figs., 56 refs. Provo, Utah, 1944.

The author gives descriptions and figures of *Melanoplus mexicanus mexicanus*, Sauss., *M. packardi*, Scud., *M. bivittatus*, Say, and *M. femur-rubrum*, Deg., which are the most injurious species of the genus in Utah, and reviews the literature on the distribution and the economic importance of each of them.

DRAKE (C. J.), DECKER (G. C.) & TAUBER (O. E.). **Observations on Oviposition and Adult Survival of some Grasshoppers of economic Importance.**—*Iowa St. Coll. J. Sci.* 19 no. 2 pp. 207–223, 7 figs., 8 refs. Ames, Iowa, 1945.

During 1938–41, last-instar nymphs and newly emerged adults of *Melanoplus bivittatus*, Say, *M. differentialis*, Thos., and *M. mexicanus*, Sauss., were collected in Iowa and kept in large screened outdoor cages. From this stock, experimental lots, each comprising 100 pairs of newly emerged adults, were taken when necessary. A mixed diet of maize, leguminous and other cultivated plants and weeds was provided twice daily. Parallel experiments were made to determine the difference in fertility and length of life of grasshoppers kept in experimental cages placed outdoors and of those in similar cages inside a roofed insectary with screened sides. The numbers of eggs laid per day per female by *M. bivittatus* and *M. differentialis* averaged 4 and 1.7 in the indoor cages and 6 and 3.2 in the outdoor ones; these data suggest that direct sunlight and other outdoor factors have a direct positive effect on egg-production. The average length of adult life in females of *M. bivittatus* was approximately three weeks indoors and four outdoors. It was rather shorter in males than in females kept under the same conditions.

The first egg-pods deposited by a female (irrespective of species) were larger than those deposited later. In general, *M. mexicanus* deposited an egg-pod every four or five days, *M. bivittatus* every ten days, and *M. differentialis* every two weeks. The average numbers of eggs per female and per pod were 129 and 69.7 for *M. bivittatus*, 128 and 88.8 for *M. differentialis* and 117 and 19.6 for *M. mexicanus*, while the maximum numbers per pod were 135, 153 and 39, respectively. In all experiments, both outdoors and indoors, approximately half of the total egg production was completed in 8–14 days after the onset of oviposition.

Mortality and egg-deposition curves for the different species were obtained, and provide data for timing and evaluating the results of surveys of adult populations carried out in preparation for control campaigns [*R.A.E.*, A 27 76.] They showed the need for careful differentiation between grasshopper species when making the surveys.

WALLIS (R. L.). **Control of the Mexican Bean Beetle in irrigated Districts in the West.**—*Circ. U.S. Dep. Agric.* no. 675, 12 pp., 3 figs., 3 refs. Washington, D.C., 1944.

An account is given of investigations in 1935–38 on the control of *Epilachna varivestis*, Muls., on beans grown for drying on irrigated land in Colorado, where it is a serious pest, especially in early-planted fields. Most of the tests concerned sprays, but brief notes are given in an appendix on the use of dusts on this crop and of sprays and dusts on beans grown for canning and on garden beans, based on work in the eastern United States [*R.A.E.*, A 25 318]. The experiments were carried out in field plots, each about an acre in extent, with power spraying equipment capable of giving a pressure of 350 lb., except in 1935, when only equipment giving 100 lb. pressure was available. A pressure of at least 150 lb. is recommended, and the nozzles should be adjusted so that all parts of the plant, and particularly the lower surfaces of the leaves, are covered. Applications were at the rate of about 125 U.S. gals. per acre and were begun when all the overwintered beetles had emerged from hibernation and before many eggs were laid (usually in the first fortnight of July). The first application is intended to prevent oviposition and to destroy the newly-hatched larvae, which feed for a few days on the leaves on which the eggs were deposited before moving to others that may have unfolded since the spray was applied. If there are fewer than five overwintered beetles per 50 ft. of row, the first application can be delayed for a few days. One or two applications are necessary.

depending on the severity of the infestation ; the dates of the second application ranged from 18th July to 7th August.

Cubé sprays with a rotenone content of 0.02 per cent. and derris sprays with rotenone contents of 0.02 and 0.015 per cent. gave 84-99, 81-85 and 78-91 per cent. control, respectively, and the increases in yield were satisfactory. The amounts (in brackets) of the other insecticides used are per 50 U.S. gals. Cryolite (3 lb.) gave 80-84 per cent. control, but except in 1937, the increase in yield following its use was greater than that from the derris or cubé and it was less costly. Zinc arsenite (1 lb) gave 88-97 per cent. control, but the increase in yield was less than that obtained with derris or cubé, probably owing to an injurious effect on the foliage. Calcium arsenate (1 lb.) gave 81-89 per cent. control, but the increase in yield was less than with zinc arsenite and it was necessary to include lime (6 lb.) to prevent injury to the foliage. Barium fluosilicate (3 lb.) was tested in 1935-37, but gave only 55-61 per cent. control, and in two of the years its use was followed by financial loss. Magnesium arsenate (1 lb.) was tested in 1935, but did not increase the yield enough to justify further investigations.

In an experiment in 1938, dust mixtures containing 0.5 and 0.75 per cent. rotenone gave 78-98 per cent. control and satisfactory increases in yield.

SNYDER (T. E.). **Powder-post Beetles and their Control.**—*Pests* 12 no. 4 pp. 8, 27-31, 7 figs. Kansas City, Mo., 1944.

The author describes the habits of the families of beetles that damage building timbers, furniture and other seasoned wood in the United States and summarises the control measures available against them. Characteristic species that are selected as examples of the respective families are the Anobiid, *Nicobium castaneum* var. *hirtum*, Ill., the Cerambycids, *Neoclytus* sp., *Hylotrupes bajulus*, L., and *Smodicum cucujiforme*, Say, the Lyctids, *Lyctus planicollis*, Lec., and *L. parallelipipedus*, Melsh., the Bostrychid, *Xylobiops basilaris*, Say, the Curculionid, *Rhyncolus (Hexarthrum) ulkei*, Horn, and the Ptinid, *Ptinus hirtellus*, Sturm (*brunneus*, Duft.). A table shows the type of material attacked and the nature of the damage caused by each, together with the appropriate control measures.

BOWEN (C. V.). **Organic Iodine Compounds tested against Insects, Fungi, and Bacteria. A Review of the Literature.**—20 pp., 111 refs. New York, N.Y., Iodine Educ. Bur., 1944.

In view of the present surplus of iodine in the United States and the possibility of producing synthetic iodine compounds with insecticidal value from some of it, the author reviews information on 294 organic iodine compounds, of which 112 have been tested for fungicidal or insecticidal action and the remainder for action against bacteria only. The compounds are named and arranged according to the scheme used in Chemical Abstracts, other names used in the references being retained as synonyms, and patent references are listed separately by number.

DAVIS (E. G.). ***Apanteles diatraeae*, a Braconid Parasite of the Southwestern Corn Borer.**—*Tech. Bull. U.S. Dep. Agric.* no. 871, 19 pp., 12 figs., 9 refs. Washington, D.C., 1944.

Papers are cited in which *Apanteles diatraeae*, Mues., has been recorded as a parasite of *Diatraea saccharalis*, F., in Mexico and Cuba and of *D. lineolata*, Wlk., in Trinidad [and it has also been recorded from *D. saccharalis* in Trinidad and Grenada (*R.A.E.*, A 32 37-38)]. Its only other known host is *D. grandiosella*, Dyar, of which it is an effective parasite in a small area in south-eastern Arizona.

It is thought to have been introduced with this maize borer from Mexico, though it does not apparently occur in the rest of the area over which the latter has spread in the United States [cf. 22 318].

All stages of *A. diatraeae* are described, and the results are given of investigations on its bionomics in Arizona, carried out in 1929-34 in the laboratory and in maize grown under irrigation at an elevation of about 2,400 ft. They showed that the eggs were deposited in the body cavity of the host larva. The number deposited at one thrust of the ovipositor ranged from 1 to 60 and the number of parasites per host in the field from 15 to 146. The larvae hatched in 4-8 days, fed inside the host for 10-25 days and then emerged and spun cocoons in a compact mass, usually in the larval burrow, but occasionally between leaves, in the tassel or in the ear. Adults emerged 7-11 days later and survived for up to 25 days. Feeding, pairing and oviposition occurred soon after emergence. Water was found to be essential, and females were able to oviposit successfully after taking water only, but lived longer if given food in the form of a sweetened solution. Temperatures of 50-70°F. appeared to be most favourable, and those above 90°F. shortened life. Unfertilised females gave rise to males only. There were four generations a year, and the parasites overwinter as first-instar larvae within the larvae of the host. Adults of the overwintered, first, second and third generations were present in the field from about 20th to 30th April, 9th to 20th June, mid-July to early September and 1st September to early October. The first generation developed in the first generation of the host, the second in the first and second generations, and the third in the third generation. Most of the overwintering larvae were the progeny of third-generation adults. Adults of the second and third generations were much more numerous than those of the overwintered and first generations, and were most abundant on plants 3-5 ft. high, possibly because such plants contained more young exposed borer larvae. Observations in 1931-34 showed that the percentage parasitism of the first and second generations of *Diatraea* averaged 3.65 and 32.45, respectively [cf. R.A.E., A 22 320] and that of the third generation in autumn 78.9; the combined effects of parasitism and cold weather kill many of the borers, especially those overwintering, so that the percentage parasitism of the overwintered larvae in spring averaged only 1.4.

No hyperparasites were observed. The ant, *Solenopsis geminata* var. *diabola*, Wheeler, attacked the pupae, but was seldom sufficiently numerous in maize fields to be of importance, and it also attacked various stages of *D. grandiosella* [cf. 22 320]. The population of *Apanteles* was reduced by scarcity of hosts in autumn owing to the increase of the egg parasite, *Trichogramma minutum*, Ril. [22 319].

Some 9,000 field-collected cocoons of *A. diatraeae* were shipped from Arizona to Louisiana and Florida in July and August 1934 for colonisation on *D. saccharalis* on sugar-cane, and about half survived the journey. The adults were released in the field, but the parasite did not become established. Previous attempts to introduce it from Mexico into Texas and [from Cuba] into Louisiana against *D. saccharalis* had also been unsuccessful.

WHITCOMB (W. D.). **The Cabbage Maggot.**—*Bull. Mass. agric. Exp. Sta.* no. 412, 28 pp., 4 pls., 1 fig., 9 refs. Amherst, Mass., 1944.

Infestation of early cabbages, cauliflowers and radishes by *Hylemyia brassicae*, Bch., at Waltham, Massachusetts, averaged 78, 71 and 66 per cent. in recent years, and damage to other cruciferous vegetables has sometimes been almost equally severe. All stages of this Anthomyiid, its seasonal history and the injury it causes to various crops are briefly described, and measures for its control are discussed in detail on the basis of investigations carried out in 1930-43, the

results of which are shown in tables. It has three generations a year, of which the first is most injurious to early cabbage and cauliflower and the third often damages late turnips and radishes, but is seldom destructive to late cabbage, though considerable populations may develop in the roots and stumps and form a source of infestation in the following spring. Eggs were laid indifferently on 13 varieties of cabbage on which observations were made in 1942-43; in general, the fast-growing varieties were most seriously injured by the larvae, though one of the latter was consistently resistant in both years.

The following is largely based on the author's summary. Preventive measures include crop rotation, autumn ploughing, and the destruction of cabbage stumps and infested turnips, which provide a source of re-infestation in the spring. In observations at Waltham in 1931-43, eggs were first found in the field between 29th April and 10th May, and control measures should be begun just before or as soon as the first eggs are laid. Treatments recommended for seed-beds are the use of cheese-cloth screens or three or four applications at weekly intervals during the oviposition period of a solution of 1 oz. mercuric chloride (corrosive sublimate) in 15 U.S. gals. water at the rate of 1 U.S. gal. per 40 ft. of row or 20 sq. ft. of bed. Coating the lower stem and roots with mixtures of mercurous chloride (calomel) and talc (1 : 1 or 1 : 3) while transplanting plants with bare roots was effective, but dipping them in a suspension of calomel in water containing various adhesives was not satisfactory. Tarred paper disks fitting tightly round the stem at soil level repelled ovipositing females and are recommended for gardens. The use of mulch paper treated with various asphalt mixtures increased plant growth, but gave poor protection and is not considered practicable.

Toxic dusts or liquid drenches are recommended for field treatment. Of the dusts, flake naphthalene was effective only if applied frequently, which makes it unsuitable for use on large plantings; it repels the ovipositing females and kills eggs and newly hatched larvae with which it comes in contact. Cubé or derris dusts containing about 0.5 per cent. rotenone were unsatisfactory. A dust of 4 per cent. calomel in talc applied at the rate of 1 teaspoonful per plant heaped round the stem gave excellent control; one application is sufficient, and 100 lb. dust is enough for about an acre. A dust containing 2 per cent. calomel was also satisfactory in experiments in 1942 and 1943 and was the cheapest treatment tested, but extreme care is needed in its application. The results of applying the 4 per cent. dust with a hand duster were less reliable and it appeared that three treatments at weekly intervals would be required to control a severe infestation. Of the liquid drenches, a suspension of calomel in gum arabic was highly effective when applied once, as soon as the first eggs were found, but is expensive and difficult to prepare. A stock suspension is made by dissolving 4 oz. gum arabic in 1 U.S. quart boiling water, grinding 4 oz. calomel with about $\frac{1}{2}$ U.S. pint of the solution until a thick paste is formed, and then adding the rest. The stock suspension is diluted in water at the rate of 1 : 40 (or 1 : 160 if infestation is light) and the resulting liquid is applied at the rate of 4 fl. oz. per plant in the field or 1 U.S. gal. per 20 sq. ft. of seed-bed. The cheapest effective drench was a solution of mercuric chloride applied at the rate of 4 fl. oz. per plant. It was most effective at a concentration of 1 oz. in 10 U.S. gals., but 1 oz. in 15 U.S. gals. water was satisfactory if carefully applied; 1 oz. in 20 U.S. gals. permitted a large increase in the percentage of slightly injured heads. Two applications, the first within a week after the first eggs are laid and the second a week later, are advisable if infestation is heavy, but one may be sufficient if it is light. Two applications of a proprietary organic mercury compound (Semesan) used at the rate of 3 oz. in 10 U.S. gals. water gave good control, but the cost was more than twice as great as that of the mercuric-chloride solution.

None of the measures tested was effective on radishes, but losses were relatively small when quick-maturing varieties were sown between 25th May and 5th June or after 10th July.

Entomology and Limnology.—56th Rep. Cornell agric. Exp. Sta. 1943 pp. 116-125. Ithaca, N.Y., 1944.

H. H. Schwardt and C. E. Palm report that, in work on substitutes for sugar and soybean meal in poison baits against the alfalfa snout beetle [*Otiorrhynchus ligustici*, L.] in New York State [cf. *R.A.E.*, A **32** 424], a mixture of apple and sodium fluosilicate was effective. It has poor keeping qualities, however, and apples are not generally available in quantity in spring. Standard wheat middlings or sawdust with small amounts of sugar, apple or soybean flour were fairly effective in preliminary tests.

Schwardt states that white grubs [*Lachnosterna* larvae] were inactive during most of 1942, as this was the third year of the brood cycle; pupae were present from the second week in July until 15th September. Adults were first found in the soil on 18th August and represented almost all the population by 8th September. Some larvae, probably individuals that were in their second year of development or that required four years to complete it, were present throughout the season. Mortality was high among pupae kept in air-dried soil with a moisture content of 12.8 per cent. and normal in soil containing 25.6 or 38.2 per cent. moisture. Tall weeds usually replace sod that has been damaged by the larvae, and areas in which this has occurred are not as a rule re-infested when the next cycle occurs and may be safely used for forest plantings or crops.

J. A. Evans, T. R. Hansberry and M. M. Barnes report that dormant sprays containing dinitro-ortho-cresol or sodium dinitro-o-cresylate gave satisfactory control of the eye-spotted bud-moth [*Spilota ocellana*, Schiff.] on apple, and that the addition of lye or petroleum oil to the dinitro-o-cresol did not materially increase its effectiveness. Nicotine sprays and dusts applied at the green-tip stage were less satisfactory, but gave some control. An attempt was made to discover a combined treatment for use against the summer-generation larvae of *S. ocellana* and the codling moth [*Cydia pomonella*, L.]. In the case of both insects, equally good results were given by sprays containing Black Leaf 155 [14 per cent. fixed nicotine] with or without summer oil at adhesive or ovicidal strength (1 or 5 pints per 100 gals.) and by nicotine sulphate with summer oil. Cryolite also gave satisfactory control of both, as did lead arsenate except in one test against *Spilota*. Dusts used against the latter were less effective than sprays.

Hansberry and L. B. Norton give the results of field tests with sprays of nicotine cuprocyanide, which had shown promise against larvae of *C. pomonella* in the laboratory [**31** 339]. This compound gave high mortality, though it was not more effective than Black Leaf 155 at the same concentration of nicotine, and caused black spots on the fruit, as also did cuprous cyanide. Nicotine cuprocyanide contains a high proportion of nicotine, and can therefore be used in small quantities that leave no visible residue. In tests of extracts of *Lonchocarpus utilis* and *L. urucu* from Brazil, at dilutions adjusted to the same rotenone content, those of *L. utilis* were the more toxic to the Mexican bean beetle [*Epilachna varivestis*, Muls.] and Aphids.

T. C. Watkins and S. H. Logan state that in tests of various insecticides against all stages of the squash bug [*Anasa tristis*, Deg.] in 1942, the most effective sprays were those containing pyrethrum extracts, though none was satisfactory against the eggs. Newly-hatched nymphs appeared to be the most susceptible. The results of a field test of various sprays and dusts were similar to those obtained in 1941 [**32** 423]. In an experiment on the food preferences of this Coreid, nearly all the nymphs counted on 20th and 21st August in a plot planted on 1st June with ten varieties of cucurbits, including melons, cucumbers, squash and pumpkins, were found to be on three varieties of squash.

Schwardt reports that adults of *Hylemyia cilicrura*, Rond., were scarce or absent after mid-July, but plots planted on 31st July and examined on 11th August showed 40 per cent. damage by the larvae and one examined on 16th

October showed 44 per cent.; the pupae from this plot overwintered. It is therefore concluded that at least two generations occur after the last spring generation. The rates of mortality of pupae kept at 85, 80, 75 and 70°F. were 88, 62, 46 and 42 per cent., respectively, though the duration of the pupal stage was not greatly affected by these differences in temperature.

W. A. Rawlins, R. W. Roth and J. E. Dewey state that in investigations on insects attacking potato on Long Island, reducing the dosages of calcium arsenate applied against the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] resulted in decreased control. Yields were substantially increased when Aphids were controlled, and vaporised nicotine has been found to be the most effective treatment for this purpose. Combinations of rotenone and pyrethrum are recommended against the potato flea beetle [*Epitrix cucumeris*, Harr.] and the potato leaf-hopper [*Empoasca fabae*, Harr.], and the increase in yield following their use exceeds that following applications of Bordeaux mixture [cf. 32 6], which gives good protection from these insects, but does not control Aphids. When Bordeaux mixture was used and nicotine sulphate was incorporated in it while Aphids were present, the increase in yield equalled or exceeded that given by the combination of rotenone and pyrethrum. Rawlins and R. O. Erickson found elsewhere in the State that when the amount of either copper sulphate or hydrated lime in Bordeaux mixture was reduced to 2 lb. per 50 U.S. gals., the repellent action against *Epitrix cucumeris* and *Empoasca fabae* increased progressively as the amount of the other compound was increased up to 8 lb.

Watkins and D. Ashdown describe experiments in which onions on several farms were treated six times at six-day intervals, beginning in early June, with a spray containing 2 lb. tartar emetic and 4 lb. sugar in 100 U.S. gals. water to control the onion thrips [*Thrips tabaci*, Lind.]. The numbers of thrips were reduced considerably but the yield was not increased where infestation was light. The greatest increase obtained was 80 bushels untopped onions per acre. Six applications, beginning on 13th June, gave a significantly greater reduction of thrips than four of a dust of Pyrocid and talc (0.2 per cent. pyrethrins) beginning on 10th July. In a preliminary test, a spray of 4 lb. sodium antimonyl hydroxyacetate and 4 lb. sugar in 100 U.S. gals. water gave results comparable with those obtained from the tartar-emetic spray.

D. L. Collins, W. E. Blauvelt and Palm, state that sprays containing bentonite alone or in combination with phenothiazine or ferric dimethyl dithiocarbamate (Fermate) appeared promising as repellents against adults of the Japanese beetle [*Popillia japonica*, Newm.] on elm.

MCGUFFIN (W. C.). **New Descriptions of Larvae of Forest Insects, VIII. Larvae of the Genus *Melanolophia* (Lepidoptera, Geometridae).**—*Canad. Ent.* 76 no. 6 pp. 124–126, 2 figs., 3 refs. Guelph, Ont., 1944.

The species dealt with in this part of a series of descriptions of the larvae of Canadian forest insects [cf. *R.A.E.*, A 32 177] are *Melanolophia signataria*, Wlk., and *M. canadaria*, Gn., which are widely distributed in eastern Canada and are recorded on coniferous and deciduous trees, and *M. imitata*, Wlk., which is confined to British Columbia and occurs on spruces and Douglas fir [*Pseudotsuga taxifolia*].

HAMMOND (G. H.). **Economic Importance and Host Relationship of *Pelecinus polyturator* Drury.**—*Canad. Ent.* 76 no. 6 p. 130, 2 refs. Guelph, Ont., 1944.

The view that the Evaniid, *Pelecinus polyturator*, Drury, is a parasite of larvae of *Lachnosterna* (*Phyllophaga*) [*R.A.E.*, A 15 45] was confirmed by

rearing it from larvae of this genus collected in Quebec and Ontario. It was found that the parasite larva remains quiescent for three days after emerging from its host and then forms a pupal envelope in which the pre-pupal and pupal stages, together lasting about 30 days, are passed. In the field, the pupae occur in the soil at depths of about 4 ins., usually in the cavity previously occupied by the host larva. The life-cycle is believed to last a year, and the larvae generally emerge from hosts that are in their third year of development. In most years, they leave their hosts between 13th and 20th July, and the adult parasites emerge between 29th July and 25th August. Parasitism is generally lower than 1 per cent., although it was nearly 3 per cent. in one district in Quebec in 1929. Adults are often common over forest and scrub land remote from pastures and meadows, and may therefore attack an alternative host, though none has yet been found.

DICKER (G. H. L.). *Tachyporus* (Col., Staphylinidae) Larvae preying on Aphides.—*Ent. mon. Mag.* **80** no. 958 p. 71. London, 1944.

Observations in April and May 1943 in strawberry fields in Kent, Hampshire, Worcestershire and the Isle of Ely showed that wherever *Capitophorus fragariae*, Theo., was numerous, it was being destroyed by larvae of Staphylinids later identified as *Tachyporus obtusus*, L., and *T. hypnorum*, F., which occurred in about equal numbers. Adult beetles were also present on the plants when the larvae were first observed. Larvae of all sizes were numerous in May and June, and some were still present in August. Small larvae taken to the laboratory became full-fed in about a month and pupated in the soil; adults emerged ten days later. There is no evidence of more than one generation a year. These Staphylinids are common in England and are not restricted to districts in which *C. fragariae* occurs.

FISHER (R. C.). A Note on *Paratillus carus* Newm. (Col., Cleridae) and Records of its Occurrence in Great Britain.—*Ent. mon. Mag.* **80** no. 961 pp. 132–134, 4 refs. London, 1944.

Instances are given of the occurrence in England of the Clerid, *Paratillus carus*, Newm., which is predacious on *Lyctus* and other small timber borers in Australia. It was first observed in England in 1933 in timber from Australia infested by *Lyctus*, and has since occurred in various parts of the country in imported timber. It has been taken each summer since 1940 at Princes Risborough during the emergence period of *Lyctus* spp., and it is evidently established there and breeding in timber infested by *Lyctus* and stored out-of-doors but protected from rain. It is also thought to be established in at least two timber yards, as it was found in them in *Lyctus*-infested wood that was not of Australian origin.

BROADHEAD (E.) & HOBBY (B. M.). Studies on a Species of *Liposcelis* (Corrodentia, Liposcelidae) occurring in stored Products in Britain. Part I.—*Ent. mon. Mag.* **80** nos. 957–958 pp. 45–59, 20 figs., 1 p. refs. London, 1944. Part II.—*T.c.* nos. 962–963 pp. 163–173, 2 figs., 1 p. refs.

Descriptions are given of all stages of *Liposcelis granicola*, sp. n., together with a detailed account of breeding experiments with it in the laboratory. It occurs as a pest in cultures of stored-product insects in southern England; reproduction is parthenogenetic, and males are unknown. The materials on which it was reared comprised yeast, mould, contaminated and sterile whole-meal flour and two synthetic diets.

RICHTER (B.). **Ein Beitrag zur Biologie und Bekämpfung der Herbstschnake.** [A Contribution to the Biology and Control of *Tipula czizeki*.]—*Kranke Pflanze* **20** no. 11–12 pp. 95–103, 5 refs. Dresden, 1943.

Following wet weather during the winter of 1941–42, vegetable crops in the floodlands of the Warthe, near Küstrin, were severely damaged in June by larvae of *Tipula czizeki*, de Jong. Where infestation was heaviest, large numbers of young cabbage plants were bitten through between the stem and root, those with malformed stems being the most seriously attacked; damage to cucumbers, tomatoes, beans and carrots was even more severe. The amount of damage varied considerably from field to field and within individual fields; some were replanted one or more times. Larval populations averaged about 30 per cabbage plant, and in some cases exceeded 50. As Pertipan [*R.A.E.*, A **31** 374] was not available, experiments, which are described, were carried out in July with other proprietary materials, but the results were not promising. Soil treatments designed to destroy the eggs were applied in November–December 1942 and February–March 1943, but their effectiveness could not be ascertained owing to the lightness of the subsequent infestation.

The degree of attack appeared to vary with the nature of the soil, moisture conditions, rotation of crops, the method and date of soil cultivation, and the date of planting. Observations in 1942 showed that populations were highest in low-lying, wet fields, and that birds destroyed large numbers of the larvae. In the surrounding meadows, where moisture conditions were more favourable than in the cultivated fields, the larvae appeared to be in better condition, and it is therefore considered unlikely that any migration took place from the former to the latter. Pupation had begun in both by 19th September. Damage continued up to 1st September, but was considerably less than it had been in June and July, and most of the young larvae present were those of *T. paludosa*, Mg. Adults of *T. czizeki*, mostly males, were in flight on 7th October, in sunny, humid weather; the females remained on the ground or on grass stems. The flies were considerably more abundant over marshy meadows than over the vegetable fields. Despite favourable weather, the adults had decreased in numbers by 20th October, and mating had apparently ceased. Larvae were first found at the beginning of May in 1943. Although the rainfall during the period January–May was approximately the same in 1942 and 1943, infestation in 1943 was light, and this is attributed to deficient rainfall in the preceding autumn and early winter and the absence of spring floods.

ENGELHART (W.). **Zur Maikäferbekämpfung.** [On the Control of *Melolontha*.]—*Kranke Pflanze* **20** no. 11–12 pp. 110–111. Dresden, 1943.

Experiments in east Holstein and the neighbourhood of Lake Constance showed that ovipositing females of *Melolontha* could be repelled from land under wheat, grass, bush fruits and other crops by treating the soil with raw or flake naphthalene. The effect usually persisted as long as the odour was clearly perceptible 3–6 ft. above soil level, and lasted for about a fortnight when some 450 lb. naphthalene was applied per acre. Several applications are therefore necessary during the flight period. Wet weather destroys the effectiveness of the treatment, and rain and cool weather cause a reduction in the activity of the beetles. At the beginning of the oviposition period, the females fly readily and are easily repelled from treated ground, but their activity gradually declines until, at the end of the period, they are not repelled even by strong, fresh naphthalene, and do not migrate far from their feeding places in order to oviposit. Tar oil and Lysol were ineffective.

SUKHOV (K. S.). **Proof of the Infectiousness of a purified Protein Preparation of Oat Mosaic Virus (Zakuklivanie in Oats).**—*C. R. Acad. Sci. URSS (N.S.)* 40 no. 4 pp. 167–169, 7 refs. Moscow, 1943.

During investigations in 1937–39 on the virus disease of cereals in the Russian Union that is known as zakuklivanie and transmitted by *Delphacodes (Delphax) striatellus*, Fall. [cf. *R.A.E.*, A 29 13; 32 316], it was found that the cells of infected oat plants contained crystals and loop-like inclusions of a protein nature that did not occur in healthy plants and that previously uninfected examples of *Delphacodes* fed on infected oats contained crystals in their intestines while those fed on healthy plants did not. Crystals from both insects and plants responded similarly to dyes and they were considered to be identical. In 1940, amorphous inclusions (X-bodies) that showed an affinity for the same dyes were found in the cells of the epithelium of the intestine, the fat-body and (in large accumulations) the salivary glands of infected insects. It thus appears that the viruses can be detected morphologically in both plant and insect.

To verify the virus nature of these inclusions, third-instar nymphs collected near Ufa in the south-east of European Russia were allowed to feed for two days through a wax membrane on a suspension of a purified preparation of the crystals seven months old. Many died in the process. Seven of ten that did not were found to contain crystals in the intestine that resembled those in insects that had fed on infected plants, and the 30 other survivors were transferred to healthy oat seedlings, of which 11 out of 17 subsequently developed the disease. In the control, 300 field-collected nymphs infected two of 92 healthy seedlings. Since some of the test insects may therefore have been infected in the field, the experiment was repeated with 60 non-infected examples; these transmitted the disease to 21 per cent. of healthy seedlings, all those in the control remaining healthy. It was also found that the insects could be infected by feeding them on aqueous extracts of infected leaves if the leaves were fresh but not if they were dry.

DUMBLETON (L. J.). **Chemical Control of *Oxycanus cervinata* Walker. III. Experiments in 1942 Season.**—*N.Z.J. Sci. Tech.* 25 (A) no. 6 pp. 256–268, 2 refs. Wellington, N.Z., 1944.

Experiments in 1942 on the control of *Oxycanus cervinatus*, Wlk., in pastures in New Zealand by means of poison baits [cf. *R.A.E.*, A 32 229, etc.] showed that the increased cost of applying Paris green at a rate greater than 2 lb. per acre was not justified by the increase in control; that lead arsenate at 4 lb. per acre, with 50 lb. bran, gave control equal to that produced by 2 lb. Paris green, for which its lower cost and readier availability make it a satisfactory substitute; that increasing the dosage to 6 lb. lead arsenate did not increase control; that Paris green at 2 lb. per acre was as effective with 25 as with 50 lb. bran; and that sawdust, chaff and sand were unsatisfactory substitutes for bran. Methods of mixing and applying the bait are described. Treatment with 2 lb. Paris green and 50 lb. bran per acre by means of a mechanical bait-spreader capable of covering 10–20 acres per hour gave satisfactory results on a field scale in several areas; it is considered that there is little or no risk of poisoning stock.

The eggs and young larvae of this Hepialid require a high atmospheric humidity for development, and infestation is much lighter on the northern aspects of ridges and hills than on level ground and southern slopes, apparently because of the greater evaporation and lower humidity on the former. Heavy rainfall in November and December in areas of normally low rainfall and high evaporation probably provide suitable conditions for hatching and thus favour heavy infestations, but this effect is complicated by the factor of pasture management, which may

provide conditions favourable for an outbreak in spite of unfavourable rainfall. Any practice that increases the humidity at the soil surface in such an area at this time tends to promote infestation. Thus, infestations commonly develop in crops that are allowed to develop seed instead of being grazed in early spring. Cover appears to have some effect even after seed harvest in January, since the presence of rye-grass straw on localised areas of a paddock seems to accentuate the damage, though the smothering action of thick deposits of straw may also contribute to this. Difference in soil type apparently has some effect on infestation; in one locality, the area that is subject to regular infestations is sandier than the rest, which has more clay. If fertilisers have any effect in promoting infestation, it is considered to be due mainly to their causing an increased growth of pasture in spring.

Considerable evidence suggests that there is a typical course for any infestation in both grass and clover. No case has been seen of attack during the first year of a pasture, though this may possibly occur with one sown in autumn. Infestation is usually light and discontinuous the second year and so heavy in the third that it may make the crop useless for pasture or seed production and necessitate ploughing up and resowing. If it is true that a heavy infestation always develops from the light preceding one and not from an influx of moths from adjoining areas, it may be advisable to treat the pasture in its second year, though more than one application of bait may be necessary.

HAMILTON (A.). *Coleophora spissicornis* Haw., the Clover Case-bearer in New Zealand.—*N.Z. J. Sci. Tech.* **25** (A) no. 6 pp. 269–273, 5 figs., 3 refs. Wellington, N.Z., 1944.

Coleophora spissicornis, Haw., was first found in New Zealand near Christchurch in 1922, but was not recognised as a pest of the seeds of white clover (*Trifolium repens*) there until 1940. The author describes the egg and larva of this Tineid, its life-history and the damage it causes [cf. *R.A.E.*, A **33** 163]. The length of time for which the larvae feed on white clover is not known, but the adults are present in white-clover areas from November until March, and are plentiful during January and February. The larvae have been taken only on white clover in New Zealand, but seeds of red clover (*T. pratense*) showing damage similar to that caused by them have been observed.

LLOYD (N. C.). **The Potato Moth. Experiments on its Control.**—*Agric. Gaz. N.S.W.* **54** pts. 7 & 9 pp. 323–327, 337, 417–421, **55** pts. 3 & 5 pp. 107–110, 126, 193–196; 7 figs. Sydney, 1943–44.

The author summarises the results of investigations carried out in 1940–43 on the life-history and control of *Gnorimoschema (Phthorimaea) operculella*, Zell., on potato in New South Wales. Studies on its life-cycle on stored potato tubers showed that development from egg to adult was completed in an average of 54·3 days in spring at 60–70°F., 27·6 days in summer at 79°F., and 19–20 days at 84–85°F., which is considered to be the optimum temperature, all in the laboratory, and 34·5 days in summer in a shed with a fluctuating temperature. The durations of the individual stages are given for all these experiments; the preoviposition period was not longer than two days in any of them. A rough surface, such as the eyes in a potato or cracks in the skin, was preferred for oviposition, and the numbers of eggs laid per female averaged 51 in spring and 48 in summer. Observations on the overwintering habits of *G. operculella* in cages showed that development under warm coastal conditions was continuous throughout the winter, though it lasted at least ten weeks. Adults were active and lived for three weeks, ovipositing freely. The larvae showed little tendency to pupate in the soil, preferring to do so in the tubers or in pieces of hessian near them, and mortality among

pupae was low. Sharp frosts and low temperatures during July and early August did not prevent development, and the moth appeared to be quite resistant to cold. Winter breeding in the field occurred on *Nicandra physaloides*, *Solanum perocaulon*, *S. nigrum*, *Datura stramonium*, *D. tatula* and tomato as well as on self-sown potatoes and tubers lying on the ground, and co-operative operations to reduce the numbers surviving the winter are important. Observations by W. L. Morgan indicate that under tableland conditions the pupae and probably also the adults overwinter in the field as well as in sheds. The larvae and prepupae do not survive, and there is no evidence that the eggs do so.

In preliminary tests of sprays that might be used against larvae or eggs on the foliage of growing plants, those containing sodium fluoride or sodium or barium fluosilicate damaged the plants, and lime-sulphur (1 : 60) caused slight injury ; white miscible oil at concentrations of up to 1 : 50, lime-sulphur (1 : 80), Bordeaux mixture (1 : 1 : 10), 2 lb. lead, calcium or basic copper arsenate per 40 gals. water, and 2 lb. tartar emetic and 10 lb. sugar per 100 gals. water were not injurious. In tests in the insectary in 1941, sprays of white oil gave just over 70 per cent. mortality of eggs at concentrations of 1 : 50, 1 : 75 and 1 : 100, but only 44 per cent. at 1 : 150, and one of white oil (1 : 75) with nicotine sulphate (1 : 400) gave 88.83 per cent. kill. Mortality of untreated eggs was 4 per cent. White oil (1 : 75 or 1 : 100) with nicotine sulphate (1 : 400) is considered to be the most effective ovicide, but drawbacks to the use of purely ovicidal sprays in the field include the difficulty of reaching all the eggs and the expense of frequent applications.

In 1942, experiments were carried out to determine whether sprays and dusts would give any substantial reduction in foliage infestation, whether such a reduction would result in lower infestation of tubers in the ground and whether they would have any effect on yield. Four applications of each treatment were made, the first 3-4 weeks after the plants appeared above ground and the others after intervals of 13, 17 and 21 days. In the first experiment, sprays of 2 lb. lead arsenate, alone or with white oil (1 : 75), or 2 lb. calcium arsenate or basic copper arsenate per 40 gals. and of Bordeaux mixture (1 : 1 : 20 and 1 : 1 : 40) all caused a significant decrease in larval infestation, the greatest (54-60 per cent.) being due to lead arsenate with oil, but none was considered sufficiently effective to afford a practical means of control. In the second, nicotine sulphate (1 : 400) with white oil (1 : 75) or $\frac{1}{2}$ lb. soft soap per 10 gals. gave hardly any control, but dusts of lead or calcium arsenate and kaolin (1 : 1) and a colloidal spray of 1 lb. copper sulphate per 32 gals. reduced infestation of the tops of the plants, and a dust of derris and kaolin (1 : 4) containing 0.94 per cent. rotenone and a spray of 3 lb. derris per 100 gals. were superior to all other treatments, giving 70-82.7 and 70.8-85.3 per cent. control. There was no noticeable reduction in infestation of tubers in either series, probably because the small plots were surrounded by untreated plants, and no increase in yield due to reduction in infestation, which was not heavy even in untreated plots ; the sprays of calcium arsenate and Bordeaux mixture (1 : 1 : 20) both tended to reduce the yield. A subsidiary experiment showed that Bordeaux mixture at strengths of 1 : 1 : 10, 1 : 1 : 20 and 1 : 1 : 40 gives a considerable reduction in infestation, though it acts slowly, but that its use at the two greater strengths was not justified. All treatments in which copper was the active constituent had a slow cumulative effect, resulting in fairly good control at the end of the experiments, but little in the intermediate stages. Insecticidal treatment of the plants is likely to be of most value under coastal conditions, where top infestation is sometimes so severe as to kill the plants.

Experiments on cultural control were carried out by W. L. Morgan and the author. In 1939-40, when the potatoes were planted at a depth of 4-5 ins., hilling 46 and 60 days after planting resulted in small though significant increases in the percentage of uninfested tubers, but not in their weight. In

1940-41, potatoes planted at a depth of 7 ins. showed substantially less infestation than those at 5 ins., and those hilled 49 days after planting less than unhilled ones, though the latter difference was not significant. Measurement of the least distance from the soil surface indicated that tubers less than 2 ins. from the surface were heavily attacked. In 1941-42, in order to test the value of late hilling, deep planting and sufficient spacing between rows to allow for a large wide hill, plants were subjected to 16 cultural treatments, consisting of all combinations of spacing 2 ft. 4 ins. and 3 ft. apart, planting at depths of 5 and 9 ins. and hilling 49, 65 and 79 days after planting or not at all. The season was unfavourable for growth and tuber development was delayed, so that the period between planting and hilling was longer than usual, but the early and intermediate hillings were carried out before and during rhizome development, and the late one after rhizome development had ceased and the tubers were beginning to swell. Hilling gave striking protection, which improved with the length of time between planting and hilling, and increased the yield of uninfested tubers for both deep and shallow planting and wide and narrow spacing. The deeper planting greatly reduced infestation under all conditions, but particularly in unhilled plots, and wider spacing appeared to result in a slightly better hill with lower infestation, which was more noticeable in the shallow planted plots; wide spacing did not reduce the yield. Late hilling was the most successful single cultural operation, but a combination of intermediate or late hilling and deep planting gave a significantly lower infestation than either operation alone. Tests of different methods of hilling showed that a broad, rounded hill produced with a hilling implement, but finished with a rake-hoe to draw the soil well up round the bases of the plants, where cracking originates, was superior to hills produced by less thorough methods. Planting in a depression, which was filled by cultivation 33-63 days later, reduced infestation slightly, but was considered ineffective. Detailed measurements of tuber depth showed that under the conditions of the experiment, only 4.2 per cent. of potatoes at least 4 ins. deep were infested where no hilling was done and that very few of the tubers of hilled plants were within 4 ins. of the surface. The safe depth is greater in soils that dry and crack badly in dry seasons and where there is a severe outbreak of the moth.

In experiments on the control of infestation of tubers at digging, apparently uninfested freshly dug tubers were put in bags that were allowed to stand in the field until next day and then stored in a barn. Those in bags, either sewn up or not, that were covered with clean bags overnight were considered unlikely to receive any appreciable infestation from outside sources, and an average infestation of 4.4 per cent. that was found in them on examination a week later is considered to be due to a primary undetected infestation in the potatoes when bagged, caused by oviposition and contamination with larvae at harvesting. Open bags that had been covered with plant tops had the heaviest infestation (16.4 per cent.); sewn bags that had been covered with plant tops or inverted and surrounded with a heaped pile of soil showed 7.6 and 11.6 per cent., respectively. The percentage infestation after storage for 14-17 days averaged 7.2 in tubers that were bagged immediately after digging and 18.2 in those that were allowed to remain on the ground for one hour. It is pointed out that even careful examination of potatoes fails to detect some that are infested with eggs or young larvae, that this infestation, which may occur at digging, is a source of considerable loss, and that tubers should therefore be removed from the field as soon as possible in warm weather if moths are numerous.

The damage to tubers stored for seed or table purposes is possibly the most serious of that caused by the larvae. Rolling tubers about for 10 seconds in emulsions of white oil at concentrations of 1:10, 1:50, 1:75 and 1:100 resulted in 100, and about 97, 85 and 96 per cent. mortality, respectively, of eggs two days old. White oil at strengths up to 1:50 caused considerable mortality of young larvae that had not entered the tubers, but older ones in

long tunnels were not affected. When exposed to large populations of moths, potatoes that had been treated with white oil (1 : 10) were much less heavily infested than untreated ones; the treatment did not prevent oviposition or hatching, but appeared to reduce entry into the tubers. The emulsion had no harmful effect on the shoots, on yields or on the vitality of new potatoes. When samples of potatoes of which some were infested with eggs or newly hatched larvae were shaken up with various dusts (2 oz. per 14 lb. tubers) for a few seconds or immersed in a suspension of insecticide for 30 seconds and then dried, examination after storage for 6-7 weeks in small bags showed that derris in kaolin gave complete control of the eggs at concentrations of 1 : 4 and 1 : 7 and of young larvae that had not entered the tubers at 1 : 4. In this test white oil (1 : 50) was ineffective against the eggs and the larvae and did not prevent reinfestation. In both untreated tubers and those treated with oil, infestation spread freely and the shoots were damaged, whereas tubers treated with derris were in good condition with well developed shoots. Another test, made by J. A. Wright, showed that derris in kaolin (1 : 4) did not prevent the destruction of potatoes that were already infested, but considerably reduced the spread of infestation to clean tubers mixed with them. In tests on potatoes infested with young larvae, lead arsenate and kaolin (1 : 1 by weight) and crude pyridine bases and kaolin (1 : 24 by weight) gave 87-100 per cent. mortality and finely ground magnesite only 44-67 per cent., as compared with no mortality in all but one of the control samples. Reinfestation took place freely in untreated tubers and less in those dusted with magnesite. The other two dusts reduced moth development so much that there was little chance of appreciable reinfestation, and they would probably prevent it to a considerable extent. They are considered to be almost as effective as derris (1 : 4) and are recommended as substitutes for it. In additional tests, pyridine dust (crude pyridine bases and kaolin, 1 : 19) controlled eggs and larvae in the first and second instars, that had just become established in the tubers, and prevented reinfestation; kaolin permitted appreciable numbers of adults to emerge from the tubers, but was almost as effective as pyridine in preventing reinfestation, and magnesite had some effect [*cf.* *R.A.E.*, A 33 31, etc.]. Dips of white oil (1 : 50) or of 2 oz. derris with 2 oz. soap in 4 gals. water killed the eggs but did not prevent reinfestation; and tobacco in a dip and a dust was worthless. Tubers treated with pyridine, kaolin or magnesite produced normal healthy plants with no stunting or retardation of shoots. When tested on a commercial scale, 5 per cent. pyridine dust reduced the development of larvae and pupae in the stored tubers, and considerably reduced subsequent infestation. Various methods of coating the tubers with dust were tested, and the most effective was found to consist in filling a bucket containing some dust with tubers, putting more dust on the top of these and then tipping them into the bag in which they are to be stored, which should have a small quantity of dust at the bottom and be shaken down to compact the potatoes in it and distribute the dust. The rate of application was about 9 lbs. per ton, or $\frac{1}{2}$ lb. per bag.

DAVIDSON (J.). **On the Relationship between Temperature and Rate of Development of Insects at constant Temperatures.**—*J. Anim. Ecol.* 13 no. 1 pp. 26-38, 6 graphs, 25 refs. London, 1944.

The author gives an analysis of published data on the duration of the egg and pupal stages of *Drosophila melanogaster*, Mg., at constant temperatures, in order to illustrate in detail the way in which his equation showing the relationship between temperature and the time required for development in insects [*R.A.E.*, A 31 421] is calculated. In addition, the essential data relating temperature to embryonic development for four species of Diptera [B 22 255] and for *Ephestia kuehniella*, Zell. [A 23 533] are used to demonstrate further the application of the equation.

It is concluded that the equation is of general application, representing the trend of the speed of development of insects for 85–90 per cent. of the complete range of temperature at which development is possible; at temperatures above the peak [cf. A 31 421], however, the observed values for rate of development are significantly less than the calculated ones.

MCLEOD (W. S.). **Further Refinement of a Technique for testing Contact Insecticides.**—*Canad. J. Res. (D)* **22** no. 4 pp. 87–104, 3 figs., 18 refs. Ottawa, 1944.

The laboratory experiments described were designed to confirm and extend the results of earlier work on the testing of contact insecticides [cf. *R.A.E.*, A 31 363] and to investigate additional points in order to contribute to knowledge of the variable factors in such work and to facilitate the securing of toxicity data reproducible within the limits of the biological variations inherent in the test animal. The following is substantially the author's abstract. Adults of *Drosophila melanogaster*, Mg., were sprayed with a solution of nicotine sulphate by both intermittent and continuous methods. There was no clearly demonstrated superiority of one method over the other. An analysis of variance performed on observed mortalities expressed as angles of equal information indicated that increasing age of flies, increasing numbers of flies per cage, longer delays between filling of the cages and spraying, and higher proportions of males in the samples increased observed mortalities significantly. The type of cloth used to cover the cages should be standardised. Data on fly ages and numbers of flies per cage were also subjected to analysis by the probit method [cf. 22 440], which indicated that flies five days old were the most susceptible and that fly numbers affected the mortalities due to all concentrations equally.

WIGGLESWORTH (V. B.). **Action of inert Dusts on Insects.**—*Nature* **153** no. 3886 pp. 493–494, 2 figs., 6 refs. London, 1944.

KALMUS (H.). **Action of inert Dusts on Insects.**—*Op. cit.* no. 3893 pp. 714–715, 1 ref.

It has been shown that certain chemically inert dusts kill insects by causing them to lose water [*R.A.E.*, A 32 38–40, etc.] and suggested that they act by affecting the permeability of a fatty film on the cuticle [cf. 32 40; 33 157]. From the experiments described in the first paper, which were carried out with nymphs of *Rhodnius [prolixus]*, Stål and have been confirmed by tests on other insects, it appears that the important factor in the action of the dusts is the simple abrasion of a film of wax that lies outside the epicuticle. When a nymph of this Triatomid is crawling, its abdomen touches the ground. In dry air at a temperature of 30°C. [86°F.] the average losses in weight in 24 hours among untreated nymphs moving on clean filter paper and among nymphs suspended in air and heavily dusted with alumina [aluminium oxide] were only 2.2 and 1.9 per cent., respectively. The loss was 43.5 per cent. when nymphs were allowed to move normally over filter paper that had been lightly dusted with alumina, but only 7.6 per cent. when their abdomens were prevented from coming in contact with the paper; the corresponding figures when powdered quartz with a particle range of 0.5–1 μ was substituted for the alumina were 17.8 and 5.2. When the abdomen did not touch the paper, the nymphs quickly became covered with the dust, but survived for many days, since abrasion was only accidental or at the articular surfaces. The average loss of weight from nymphs moving on emery paper was 7.8 per cent.

Polyphenols, which reduce ammoniacal silver-hydroxide, are known to occur in the outer layers of the insect cuticle, but when an insect is placed in the silver solution, no reduction takes place. When nymphs that had been moving over emery paper or dusted filter paper were immersed, however, the

projecting parts of the cuticle were stained brown, demonstrating that reduction had occurred; no visible change could be discerned by microscopic examination before treatment with the solution. Living insects that have been rubbed lightly with dust recover their impermeability to water if kept in a moist atmosphere, and a waxy bloom appears on the rubbed surface; recovery is much less complete if the dust remains on the cuticle, and does not occur at all in dead insects. It therefore appears that adsorption of the wax is of importance, at least while it is being secreted.

The action of certain diluents that increase the toxicity of dust insecticides [31 490] may be due to their abrasive or adsorbent properties. When 2 per cent. nicotine is applied to a definite area on the back of a nymph of *Rhodnius*, the effects do not become severe until 24 hours have elapsed, but the nymph dies within 20 minutes if the back is first rubbed with alumina dust. Nymphs treated only with powdered rotenone remained alive for weeks, but succumbed in less than 24 hours when treated first with alumina dust.

The results given in the second paper confirm those described in the first. Loss of water was most rapid in insects shaken with a dust of charcoal of either plant or animal origin. At 25°C. [77°F.] adults of *Drosophila melanogaster*, Mg., and *D. subobscura*, Séguy, were killed after 11 and 9 minutes, respectively, when the relative humidity was 40–50 per cent., but survived for many hours in a saturated atmosphere. Mosquitos and house-flies [*Musca domestica*, L.] kept in a room with central heating after being dusted with charcoal survived for less than an hour. When kept in charcoal, larvae of *D. melanogaster* lived for several hours, and pupae were not affected, but adults from the latter died soon after emergence. Adults immobilised by means of carbon dioxide survived for several hours in charcoal, but died in ten minutes after being allowed to recover and move about in normal air. At 5°C. [41°F.] and a relative humidity of 70 per cent., adults survived in charcoal for several hours, but they became desiccated and did not recover if they were immobilised by means of carbon dioxide or by chilling after moving in charcoal for 2–3 minutes. First-instar nymphs of *Dixippus* treated with charcoal also survived longer when immobile than when active. Microscopic examination of late-instar nymphs of *Dysdercus* sp. that had been dusted with charcoal and turned on their backs showed that the cuticle of the abdomen was scratched where the femora had rubbed against it; when rubbing was prevented by removing the legs before applying the dust, the nymphs survived much longer.

BARTHEL (W. F.), HALLER (H. L.) & LaFORGE (F. B.). **Pyrethrins for Aerosols. The Preparation of 98% pure Pyrethrins for Use in Freon Aerosol Bombs.**—*Soap* 20 no. 7 pp. 121, 135, 3 refs. New York, N.Y., 1944.

The authors describe a method of preparing a concentrate containing 90–100 per cent. pyrethrins, which retains its full effectiveness and may be made from crude materials. It contains nothing that might cause irritation or interfere with its use in aerosols by clogging the nozzle of the container [*cf.* *R.A.E.*, A 33 142]. A commercial solution of 20–25 per cent. total pyrethrins in a high-boiling hydrocarbon solvent is agitated with nitromethane, which extracts the pyrethrins from their original solvent, but leaves most of the fatty acids, oils and other impurities. Three extractions with about equal volumes of nitromethane remove 97 per cent. of the total pyrethrins. Removal of the nitromethane solvent gives a concentrate that contains about 60 per cent. total pyrethrins and could be used for the preparation of the semicarbazones, but further purification is obtained by drawing the nitromethane solution through a column of activated carbon. A nearly colourless solution results, which yields a syrupy liquid containing 90–100 per cent. total pyrethrins on removal of the solvent in vacuum; this amounts to 85 per cent. of the pyrethrins originally

contained in the commercial product and furnishes a mixture of crystalline semicarbazones that closely approaches the theoretical yield.

Several similar commercial preparations were found to be suitable as starting materials, and no special quality of adsorbent carbon was required. A few commercial samples did not provide the anticipated quantities of pyrethrins and evidently underwent rapid deterioration; it appears that polymerisation with the formation of insoluble products may be involved. However, a 90 per cent. concentrate was obtained from such deteriorated material by digesting the nitromethane extract with petroleum ether, which dissolved the unchanged pyrethrins and left a viscous insoluble syrup that separated completely on standing, and evaporating the solvent.

In experimental work, 500 gm. 20 per cent. pyrethrum extract in deodorised kerosene was agitated with three successive portions of 250 ml. nitromethane. The emulsions sometimes encountered at this stage were readily dispersed by playing a high-tension spark on a copper wire dipping to the bottom of the vessel. The separated nitromethane solution was passed through an eight-inch column of activated carbon $1\frac{1}{2}$ ins. in diameter, which was then washed twice with 100-ml. portions of nitromethane. The solutions were combined and the nitromethane was removed by distillation under reduced pressure. The remaining concentrate contained 98 per cent. pyrethrins, as determined by the A.O.A.C. method, and weighed 90 gm., which is equivalent to 90 per cent. of the pyrethrins in the original preparation.

COX (A. J.). **Insecticide Testing. A Review of Test Procedure for evaluating Household Insecticides for Use in the Control of Flies, Clothes Moths, Roaches and Rodents.**—*Soap* 20 no. 6 pp. 114–117, 149, no. 7 pp. 123, 125, 129; 11 figs. New York, N.Y., 1944.

Descriptions are given of the procedures adopted by the Bureau of Chemistry of the Californian Department of Agriculture for testing the effectiveness of household insecticides. They include a method of rearing the webbing clothes moth [*Tineola biselliella*, Humm.], which is the species employed for testing products sold in California for use against clothes moths, and methods of testing against it materials intended to treat fabric [*R.A.E.*, A 31 318], fumigants of low volatility and repellents. To obtain a stock of larvae, 150–200 newly emerged moths are placed in a quart jar and removed after a day or two when large numbers of eggs have been laid. Sterilised powdered dog food is then provided for the larvae, which are spread out on a tray 25–27 days after hatching and transferred to test fabric when they have crawled from their webs.

PLUMMER (C. C.). **Laboratory Studies on the Toxicity of Tartar Emetic to the Mexican Fruitfly.**—*Circ. U.S. Dep. Agric.* no. 697, 14 pp., 1 fig., 14 refs. Washington, D.C., 1944.

Details are given of experiments carried out since 1932 on the toxicity to *Anastrepha ludens*, Lw., of tartar emetic, which has proved to be one of the most effective materials tested in the laboratory and in the field in bait-sprays for its control in Mexico [*cf.* *R.A.E.*, A 26 325]. The salient features have already been noticed from an abstract of another paper [31 276], but it now appears that the mortality of flies exposed to the dried residue of a solution of tartar emetic and sugar was more rapid in tests started at 6 a.m. than in those started at noon, 6 p.m. or midnight, as would be expected, since the flies feed principally in the morning.

CUTRIGHT (C. R.) & PARKS (T. H.). **The Apple Maggot.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **29** no. 228 pp. 168–172, 5 figs. Wooster, Ohio, 1944.

In 1943, a serious outbreak of the apple maggot [*Rhagoletis pomonella*, Walsh] occurred in northern Ohio, where it has caused damage to apples every year since 1929. This Trypetid was much more injurious than usual in areas from which it had previously been reported and extended its range to the west and south, so that it occurred in all the principal apple-growing sections of the State. A brief account is given of its bionomics, together with recommendations for control by means of insecticides applied during the pre-oviposition period. In Ohio, the adults emerge from about 4th July until 25th August at Wooster and until after mid-September in Lake County, but chiefly during the last two weeks in July and the first in August. The preoviposition period lasts 7–10 days. *R. pomonella* is not injurious in orchards that are thoroughly sprayed against the codling moth [*Cydia pomonella*, L.], but in others sprays of 3 lb. lead or calcium arsenate per 100 U.S. gals. water, with the usual amount of lime or zinc sulphate and lime and a sulphur fungicide if necessary, should be applied to all trees in time to kill the flies that have emerged early and again about three weeks later. In some cases, three applications may be necessary. Arsenical dusts give satisfactory control, but may be washed off by rain; phenothiazine sprays and rotenone dusts are the only non-arsenical insecticides known to be effective. Supplementary measures suggested for small orchards include gathering the fallen apples every 1–2 days, before the maggots can leave them and enter the soil, and burying them or making them into cider. Infested apples that are to be used later should be kept in cold storage; otherwise injury will continue and decay may set in. Cold storage for at least six weeks kills all the larvae and eggs in the fruit.

ISELY (D.) & MINER (F. D.). **The lesser Cornstalk Borer, a Pest of Fall Beans.**—*J. Kansas ent. Soc.* **17** no. 2 pp. 51–57, 1 fig., 4 refs. Manhattan, Kans., 1944.

Elasmopalpus lignosellus, Zell., which has occasionally caused local injury, particularly to maize, beans and cowpeas, in Arkansas in the last 20 years, caused general and severe loss of autumn beans, amounting in many cases to over 50 per cent. of the plants, in the north-west of the State during August 1943. Larvae were also present on early beans, maize and sorghum, but did not cause obvious injury to them. Most of the food-plants on which this Pyralid has been recorded in the United States [*R.A.E.*, A **5** 578] are graminaceous or leguminous, but it has also been found attacking turnips and, in Arkansas, strawberries. When both beans and maize were available, the latter was preferred, and the survival of newly hatched larvae was higher and larval development more rapid on this plant.

Young bean plants were most susceptible to injury during the first two weeks that they were above the soil; larvae attacked the stem, usually below the surface of the soil, fed within it and then migrated to another plant. A plant injured in this way wilted within a day and a single larva was capable of destroying several seedlings. Bean plants 60 or more days old could support several larvae without being noticeably injured; usually the green tissues round the underground stem were attacked, but the larvae were sometimes found within the stem itself. They were frequently much more numerous, though less injurious, in fields of well-grown beans and maize than on late beans. They were also collected on the underground stems of various wild grasses in the bean fields. In August, full-grown maize plants showed burrows within the roots, particularly those nearest the surface of the soil; larvae were also found feeding on the green part of the cortex of stalks behind the leaf sheaths at the lower nodes. Both the underground stems and developing pods of ground-nuts were injured.

The abundance of the borer in 1943 was due to heavy rainfall during May and June, which resulted in widespread growth of crab grass [*Digitaria sanguinalis*], its most important wild food-plant, and the heavy damage caused was due to the great increase in acreage of a suitable food plant. Most of the infested fields had produced a spring crop of beans, and all had contained a heavy growth of crab grass and other grasses. Some had been ploughed and disked a few days or weeks before planting, but in no case had all the grass been destroyed, and partial destruction of the wild food plants had apparently hastened migration to the new crop. There appeared to be a rough correlation between the amount of crop and weed residue in a field and the severity of infestation. The only uninfested fields were those in which all weed and crop residue had been destroyed by early cultivation or flooding, and it is concluded that clean cultivation before planting would prevent outbreaks, since larvae that had begun their development on other plants would not be present when bean seedlings came up, and larvae from eggs deposited after the residue was destroyed would not become injurious until the beans had passed the susceptible stage. Inspection of the underground stems of food-plants before planting beans to determine whether a destructive infestation was present would show whether these measures were necessary. The destruction of plant residues during winter would greatly reduce the severity of early infestations and thus indirectly protect late crops, but the moth has several generations a year and may be numerous in summer even though the first generation is small. Dusting the stems and lower surfaces of the leaves with cryolite, barium fluosilicate or calcium arsenate against migrating larvae did not give satisfactory control.

BAWDEN (F. C.). Plant Viruses and Virus Diseases.— $10\frac{1}{2} \times 7$ ins., xi+294 pp., frontis., 48 figs., many refs. Waltham, Mass., Chronica Botanica Co.; London, W. Dawson & Sons, Ltd., 1943. Price \$4.75. [Recd. 1945.]

This comprehensive work includes chapters on the symptomatology of virus diseases of plants, virus strains and their origin, the serological reaction of plant viruses, methods for obtaining pure preparations, the chemical, physical and optical properties of purified preparations, the inactivation of viruses, the size of virus particles, the physiology of plants infected by virus diseases, the classification of viruses, and their origin and multiplication. A chapter on transmission includes a short section on insect vectors, a large part of which comprises a list of 54 of the most important, together with the viruses transmitted by them; in another chapter (pp. 67-88) the relations between viruses and their insect vectors are discussed at length; and a third, dealing with the control of virus diseases, contains a section in which are given examples of the ways in which insect-transmitted diseases can be controlled or prevented by means of insecticides, cultural measures, the use of stock raised in localities unfavourable to the vectors, and precautionary measures for the raising of stock in localities where they are present.

PAPERS NOTICED BY TITLE ONLY.

IMPERIAL INSTITUTE. Quarterly Bibliography on Insecticide Materials of Vegetable Origin, Nos. 26-28 (January to September 1944).—*Bull. imp. Inst.* 42 nos. 2-4 pp. 95-99, 181-185, 264-272. London, 1944. [Cf. *R.A.E.*, A 32 224.]

MADDEN (A. H.). The external Morphology of the adult Tobacco Hornworm [*Protoparce sexta*, Joh.] (Lepidoptera, Sphingidae).—*Ann. ent. Soc. Amer.* 37 no. 2 pp. 145-160, 19 figs., 8 refs. Columbus, Ohio, 1944.

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